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A MANUAL

FOR

HEALTH OFFICERS

BY

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WITH A

FOREWORD

BY

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PREFACE

The aim of this volume, as a general guide for health officers, is clearly indicated in the Foreword. Its scope, however, as the work progressed, has been enlarged over that of a simple manual by the inclusion of a considerable amount of reference matter which it was thought should be thus readily available. And, while the needs of the local health office have dictated the content, certain portions of the volume — e.g., those summarizing tuberculosis, infant hygiene and publicity work — may be of service to persons engaged in the work of unofficial organizations concerned with those subjects.

Emphasis has been placed upon practical administration, the more abstract principles of sanitary science being presupposed. So far as possible definite procedures are given, but in regard to the many matters on which no such procedure can at present writing be positively deduced, an effort has been made to indicate the chief considerations at issue.

References, suggestive rather than exhaustive, are frequently given, not only to substantiate specific statements, but also to serve as indications for further study along particular lines. On page 98 is given a list of the literature of chief general interest to the health officer.

In the three principal needs in the public health field today — (1) scientific definition of principles of procedure, (2) improved organization and (3) trained sanitary officers — progress is being made. Not only is this observable in individual cities and towns, but in the advances in the sanitary systems of whole states. A recent example of

this is to be seen in the recent reorganization in New York State with the conferring upon the State authorities of local supervisory powers and the adoption of a State sanitary code. To such developments, which cannot be treated in detail in such a volume as the present, attention is called, as most clearly exemplifying the present-day public health movement.

Aside from many sources of data which cannot be particularized here, special acknowledgment is due for the courtesy of Dr. M. J. Rosenau and his publishers, Messrs. D. Appleton and Company, in permitting the use of considerable excerpts on disinfection from his work "Preventive Medicine and Hygiene" (1913); also to Professor G. C. Whipple for extracts on epidemiology from his "Typhoid Fever" (1908). Particular thanks are due to Mr. Franz Schneider, Jr., of the Department of Surveys and Exhibits of the Russell Sage Foundation, for reading the entire manuscript and making many useful suggestions. Advantageous criticism on the subject of publicity was also received from Mr. E. G. Routzahn, Director of the above-mentioned Department. To Professor W. T. Sedgwick, of the Massachusetts Institute of Technology, the author is indebted for the original suggestion from which the present work took its inception, as well as for subsequent advice and encouragement.

J. S. M.

BOSTON, *April*, 1915.

FOREWORD

Some three years ago when the author of this book (whom I am glad to be able to claim as a former pupil) was serving as the Health Officer of Orange, New Jersey, I urged upon him the importance of preparing a Manual or Handbook which should do for health officers what the various handbooks for civil engineers, mechanical engineers and other technicians do for persons engaged in those professions. Fortunately, in 1913, Mr. MacNutt was enabled to withdraw from his official position and, after devoting a year of quiet labor to the task, has now completed the first edition of a manual such as I had in mind. This, I believe, will be of great service to health authorities of every kind, who will here find carefully laid down the fundamental data of their profession, and to all such I therefore heartily commend it.

At the end of the nineteenth century the public health officer when he existed at all was generally merely a physician who had assumed the title and who gave to the office only a small part of his time. Of any special training for public health work he was blissfully innocent. Of water supply, sewerage, milk supply, insects, infant mortality, school hygiene statistics, ventilation and similar topics so indispensable today he had little or no knowledge. His interest began — and too often ended—at the bedside and the hospital. But with the recent remarkable development of sanitation, preventive medicine and hygiene; with the recognition of the significance of pure milk, pure water, pure air and pure food; with the modern emphasis upon the transmission of disease by insects and by carriers; and

with the growth of sanitary law and Federal, state and municipal regulations, the problems and practices of health authorities, whether physicians or laymen, have become so highly technical as to require special preparation and technical knowledge. Hence it is not too much to say that within the last decade a new profession has arisen in America, namely, that of *the trained and full-time health officer.*

For health officers, boards of health, and all other health officials Mr. MacNutt's Manual will be of immediate practical value. To the beginner it will be especially helpful since it virtually records the practical results of the author's personal experience in the profession. For students in training, such as members of schools for health officers, and for students pursuing special courses in public health science in medical, scientific and technological Schools it should serve also as an indispensable guide to those subjects requiring most careful consideration.

William T. Sedgwick

CONTENTS

PART I

HEALTH AUTHORITIES: THEIR ORGANIZATION AND POWERS

PART II

PUBLIC HEALTH ADMINISTRATION

CHAPTER I

CHAPTER II

CHAPTER III

CHAPTER IV

CHAPTER V

CHAPTER VI

CHAPTER VII

CHAPTER VIII

CHAPTER IX

CHAPTER X

APPENDIXES

CHARTS

PART I

HEALTH AUTHORITIES

THEIR ORGANIZATION AND POWERS

A MANUAL FOR HEALTH OFFICERS

CHAPTER I

LOCAL HEALTH AUTHORITIES

The chief basis of sanitary authority in any community is essentially local. That authority is commonly vested in the local board of health and its officers, although in some small communities where no such board is appointed the sanitary authority is exercised by the selectmen, township committee or other governing body. The local board of health was in origin the earliest, and is now in operation the most powerful, sanitary unit.

In all except the most undeveloped and primitive communities, boards of health entrust their executive work to a staff headed by a "health officer" (or "health inspector"; sometimes "health commissioner"), who is assisted by subordinate sanitary inspectors and other employees. The health officer attends to matters of routine and takes such executive action as he may be empowered to take between sessions of the board. The board retains a directive power: makes regulations, prescribes the general manner of their enforcement, and decides important questions of administrative policy and procedure. Thus the fundamental authority and responsibility reside in the board and are exercised by the health officer only in so far as they are delegated to him by the board.

LOCAL ORGANIZATION

The Health Officer and the Board. — The health officer, staff and board constitute the department of health of any community. The terms "health department" and "health authorities" will be given preference in these pages, not only as being the most inclusive terms, but — and chiefly — to indicate that the most important factor is not, as popularly supposed, the board of health, but the trained health officer and his staff. In fact, it is maintained by many who have observed the practical workings of health authorities that the majority of local boards of health are weakened by political interference, or are at any rate incapable of dealing intelligently with the technical details of administration which come before them, and it has been asserted by some that they could to great advantage be abolished and their powers be turned over bodily to a well-trained, expert health officer. The average local board of health, it is urged, does not mend the acts of an inefficient health officer, while to the expert health officer it may be a positive hindrance, blocking despatch and putting a damper on effective administration.

It is indeed true that the expert health officer, with an expert staff, is the chief figure in public health administration to-day. It is he, and not the board, who initiates and who executes; it is he only who can have that intimate and exact knowledge of principles and conditions which is necessary for effective action, nor is there any question that the average board of health is a body incompetent to pass upon such details.

There is, however, another view of the matter, — namely, that the board acts as a mediator between the public and the health officer. As a body it is (or should be) fitted to deal with those large questions of sanitation which affect public standards — sanitary, social, economic, and other — in an important degree. Such questions are

in the final decision non-technical in nature, framing themselves in the form: Granted that such-and-such a step will bring a certain degree of benefit to the public health, is it worth the costs — in money and otherwise — entailed?

In rural districts, where a state or county code can be drawn up for large areas, it is doubtless best that (as outlined in Chapter II) local boards of health be abolished and that the health officer be made accountable to expert state or county authority. But in towns and cities, which have a greater degree of civic individuality, the board seems likely, for the present at least, to remain. It acts as a check on the health officer, preventing him from putting impracticable schemes into effect, but at the same time giving him the backing of its prestige in difficult cases. It may, by acting in a quasi-judicial capacity, prevent cases from going to law. It may secure the coöperation of other official bodies more readily than could the health officer alone, and obtain appropriations more readily. Under a commission form of government boards of health are naturally and possibly with advantage done away with, but under present conditions in most communities their abolition does not seem advisable. Inefficiency of boards simply indicates that their personnel should be improved through higher civic standards and better appointments. The appointment of members for political reasons and not for qualifications is at present the chief evil.

Those who urge the abolition of boards of health should consider the question of accountability. While, in order to secure prompt and effective action, the expert health executive should undoubtedly be given a wide range of discretion in dealing with matters for which a general course has already been laid down, he must nevertheless be subject ultimately to some extrinsic control. The question therefore is, what that control should be. In those instances where the board has been abolished he still remains responsible to a superior body or officers —

as, for example, under the New York plan of supervisors or under a commission form of government — besides being governed by a code of sanitary laws established by superior authority.

Organization of Local Boards of Health. — While not always a popularly elected body the board nevertheless represents the public in that it acts as mediator between health officer and public. As remarked above, the board is the judge of the *non*-technical aspects of a question, just as the health officer is the judge of its technical aspects. Thus acting, the board is by no means an expert body. Its members need simply be intelligent citizens who will understand thoroughly and judge wisely the proposals and cases brought before them.

Composition

The special, or professional, qualifications of the individual members, though frequently important, are secondary. It is seldom that the board can be anything approaching an expert commission, and almost all expert advice needed must be furnished by the health officer. It is customary to consider physicians as best fitted to serve on the board of health, and it is desirable that that profession be represented by one member at least, particularly if the health officer himself be not a medical man. It is an error, however, to make the board a medical monopoly, as is sometimes done, and laws so tending should be abolished. The coöperation of the medical profession, and to a certain extent its advice, are required, but not entire control by it. There are other things to be considered. For example, questions of drainage, water-supply, and the like not infrequently arise, and it may be well that one member of the board be a sanitary engineer, especially if the advice of the town or city engineer be not readily available. Plumbing inspection is sometimes unduly predominant and that trade given undue prominence on the

health board. As elsewhere pointed out, plumbing inspection is relatively unimportant from the health standpoint and is best assigned to some other city department, in which case no attention need be paid to it in the organization of the board of health.

The members may properly be appointed by the mayor, and to limit responsibility for the appointments it is probably best that they be not subject to confirmation by the common council or other governing body. The board should be as small as possible — not over five members — for experience seems to indicate that the larger boards are less likely to be harmonious and effective. The health officer should not be a member of the board, for in that case he would be placed in the inconsistent position of voting on his own acts and proposals. On the whole it is best to make the health board as distinct a body as possible without including in it (as has been suggested) the mayor and the heads of other city departments, for these officials have their own distinct interests which are only indirectly connected with health administration.

Status

The health board should have full executive powers and not be emasculated by limitation to merely legislative and advisory functions. It should not be responsible to the council or any other body for its acts, so long as these are within the powers conferred by law, and should be entitled to at least a certain minimum appropriation. It should have entire control of the appointment of its employees, including the health officer.[1] Some general supervision by

[1] In New Jersey a statute requires that the council or other local governing body appropriate to the local board of health at least a certain annual minimum sum (ten cents per capita of population, which, however, is very insufficient for the needs of the average community). In that State it has also been ruled that boards of health are not merely municipal boards bearing an accountability to the council or other local governing body, but that once the latter has appointed the board and granted an appropriation it has no further control. Needless to say, however, there should be full coöperation between the bodies.

state health departments over the standards maintained by local boards is, however, desirable.

It does not seem advisable that members be remunerated for attendance at meetings, for much of the best service is rendered by unpaid boards, while the absence of fees removes an inducement to make the appointments political prizes. In order to secure the benefits of experience the terms should be three years or more, not expiring simultaneously, and members should be eligible for re-appointment. Meetings should be open to the public and "press" except when very unusual circumstances may render " executive session " desirable.

LOCAL POWERS AND PROCEDURE

The activities of the local authorities are essentially *executive.* Legislative power, strictly speaking, they have not, for any regulations which they may make can only be in amplification and not in extension of fundamental statutes. Nor have they judicial power, for their decisions are not binding until passed upon by a court of law; they cannot decide their own legal suits nor impose penalties.

The first requisite for the exercise of authority is legal right. In the case of the board of health that right is based entirely on the will of the state legislature as expressed in the public health statutes. It must ever be borne in mind that the board cannot rightfully issue any order nor perform any action which is not authorized, either expressly or implicitly, by the organic law of the state.

The board may and should exercise its statutory powers in two ways. First, it may act directly upon such provisions of the *statute law* as directly provide for the action in question. As a rule, however, public health statutes make few specific provisions, but are couched in such general terms that to rely directly upon them in executive action is an uncertain or inadequate proceeding. Hence

it is customary for local boards to adopt *local ordinances* or regulations (sometimes called collectively the " sanitary code " or " health code ") based upon and amplifying in detail the general provisions of the statutes. Without such ordinances effective local work is impossible. The great advantage of such ordinances is that they may readily be framed to suit local conditions and standards. Such ordinances have all the force of law except as they may be disapproved on legal grounds when tested in courts of law.

Procedure

Having, then, a legal basis to work on, the health authorities must first make *inspections* and *examinations* in order to determine whether or not conditions within its jurisdiction conform to the provisions of the sanitary law. Such investigation may take any form so long as it is reasonable and has a legitimate object in the protection of the public health. This function implies of course the " right of entry," i.e., to enter at proper times into and upon all premises for the performance of duty, to be enforced by search warrant if necessary. It also implies the right to examine persons in order to make diagnoses and the right to keep such persons under observation if advisable. Again, it implies the right to take and examine bacteriological specimens, such as diphtheria cultures, of various kinds; and to collect and examine specimens of foods, drugs, etc. In short, the health authority has wide powers, to be exercised of course in a reasonable manner, of investigating persons, places and things.

Then, having the authority of sanitary law on the one hand and a knowledge of certain facts on the other, the board of health proceeds to *deliberation* as to what action, if any, is necessary under the circumstances. If it is decided that some action is necessary — that a certain condition should be remedied — then the next step is to deal with the person (or persons) responsible for the con-

dition. Such person is customarily accorded the right to be heard and to present any considerations in his favor before action is actually taken.

The *action*, when taken, may consist in a formal notice, or perhaps simply warning or advice. Finally, if a remedy can be effected in no other way, legal suit may be instituted against the person responsible for the violation of the sanitary law.[1] The board of health rarely takes arbitrary action into its own hands and then only when an action — e.g., the abatement of a nuisance or the destruction of infected food — is urgently demanded and can be accomplished in no other way. In such instance there must be full legal power and a perfectly clear case, and action must be strictly in accordance with legal procedure. Even when disinfections are performed by the authorities the theory is that this is merely a matter of convenience and effectiveness for private parties who would otherwise have to attend to it themselves under official supervision. Where specific action is desired the object of the sanitary authorities is to induce that action on the part of private persons rather than to undertake the uncertain proceeding of themselves intruding into private affairs.

An *order* of the board of health (issued usually by its health officer) is a notice to the person responsible to the effect that a certain condition is contrary to a certain sanitary ordinance and directing that person to take action to avoid further violation of the law. The action ordered may be to improve a milk supply, to alter a tenement, or perhaps simply to refrain from further commission of an act detrimental to the public health. The person receiving the notice then has the option: either to comply with the order, or to disregard the order under peril of proceedings by the board. Such proceedings may consist in a suit instituted by the board to recover the penalty incurred, or,

[1] Or in some instances as a preventive measure (through injunction) in advance of a threatened violation. See Part II, Chap. 6.

in extreme cases, the board itself through its agents remedying the condition complained of. (For further details as to procedure see Part II, Chapters 6 and 7.) In a dispute before the law the board and the private party have equal rights to be heard and the court will require the board to prove its case before giving judgment in its favor. The probable attitude of a court of law toward a given question should therefore always be borne in mind in the deliberations of board and health officer.

Special Functions

In addition to the fundamental functions already outlined, health authorities have to maintain certain functions of an auxiliary, though none the less an indispensable, nature. Laboratory service for bacteriological diagnosis and for examination of food, water, etc.; the distribution and perhaps administration of antitoxins and vaccines; research and publicity work; the registration of the vital records of births, marriages and deaths, — are the principal of such functions.

Need of Executive Staff

Now, how are all these functions actually to be exercised? The board of health obviously cannot as a body undertake such matters as the inspection of many different conditions and the collection of the data necessary for wise decisions on technical questions; nor can it intelligently consider questions of medical diagnosis, sanitary and diagnostic bacteriology, and the like. The board, moreover, is only in session at certain times and there is a great deal of business to be handled between sessions. Hence it is that inspections and investigations, routine and also many matters involving discretionary action and decision are delegated by the board to an executive staff headed by the health officer. The board therefore simply directs in a general manner, leaving discretion in execution and

detail to the health officer and his assistants acting on the authorization of law and the decisions and established policy of the board.

THE STAFF

The Health Officer,[1] or chief sanitary executive, stands in a twofold relation to the board of health: first, as *expert adviser;* second, as *executer of laws and orders.* In other words, his duties are:

(1) To investigate conditions;

(2) To report upon them to the board, with recommendations for action; and

(3) To execute (with the assistance of his staff) the specific action authorized as well as the ordinary activities of the health department.

The position of the health officer is thus analogous to that of the superintendent of schools, of police, of public works — in short, of any main branch of the municipal government. In Providence, R. I., he is in fact styled "Superintendent of Health." He should be responsible to the board of health directly and solely.

Relation to the Public

In his relation to the public the health officer stands as the representative of the board of health. Between sessions of the board, which are usually infrequent, he is the chief sanitary authority. He receives the complaints and petitions of citizens and puts in effect all feasible remedies. While he is presumed to act with the consent of the board, if not by its orders, administrative efficiency

[1] The health officer is sometimes known by other titles: as "health commissioner" (especially in the larger cities) or "health inspector" (in small towns). In Massachusetts he is designated as "agent of the board of health." The title as here used refers to the chief sanitary executive of the local board of health, whether he act alone or with assistance. The term "sanitary inspector" is reserved for subordinates to the health officer.

demands that within the law wide latitude be allowed him, not only in matters of routine and detail, but also for action in emergencies. In many instances the action taken is virtually that of the health officer alone, though such action, to be valid, must be either preordained or at any rate ratified by the board. For example, Massachusetts statute law[1] provides that:

> The board of health in a city or town may appoint an agent or agents to act for it in cases of emergency or if it cannot be conveniently assembled; and any such agent shall have all the authority which the board appointing him had; but he shall in each case report his action to the board within two days for its approval, and shall be directly responsible to it and under its direction and control.

Relation to the Board

Such a relationship should be established between the board and the health officer that when the latter acts reasonably and in accordance with the ordinances and general policy of the board he will be supported by it. Thus, by exercising proper discretion the health officer may wield a large degree of power without exceeding the proper conduct of his office. The degree of discretion which he may properly exercise without referring matters to the board for action will depend on local law and custom and on the nature of the individual case. He should not, of course, pass beyond at least a general authorization. There should be at once effectiveness of action, legal validity of action, and mutual confidence between board and health officer.

One of the tendencies in public health organization at the present time is to concentrate sanitary powers, to give the chief executive greater power. This favors efficiency, provided the executive is still subject to proper checks. As Lord Bacon says in his essay on Dispatch: "There be three parts of business; the preparation, the debate or examination, and the perfection. Whereof, if you look

[1] Revised Laws, Chap. 75, Sec. 13.

for dispatch, let the middle only be the work of many, and the first and last the work of few." Such a tendency is the natural development of more highly specialized administrative powers. To use a mechanical analogy, the health officer should be the prime mover, and his staff the auxiliary machinery, while the board of health acts as a governor.

Training and Qualifications

The position of health officer requires both technical and administrative ability. The two are distinct and equally important. The technical school graduate who lacks the ability to put his scientific knowledge into practical effect is as badly off as the man of mere experience who knows nothing of scientific principles.

Contrary to the common impression, health officers need not necessarily be physicians — though a medical training is highly useful — and there is now some trend toward the non-medical, though specially trained, health official. Already there are in practice able health officers trained, not in medicine, but in sanitary biology or sanitary engineering.[1]

The *technical training* necessary to health officers is best obtained in a school having a special department devoted to this subject. As the most prominent illustration of this we may mention the School of Health Officers recently instituted under the joint management of Harvard University and the Massachusetts Institute of Technology, with courses in all the branches of public health work.[2]

[1] Knowles, "Public Health Service Not a Medical Monopoly," and Wells, "A Plea for a More General Recognition of the Qualifications of the Sanitary Engineer for Administrative Public Health Work," *Am. Jour. Pub. Health*, 1913, vol. III, no. 2.

[2] See Whipple, "Public Health Education" (with special reference to the above school), address before N. Y. State Conf. San. Officers, *Science*, 1914, N. S., vol. XL, p. 581. A number of medical schools now give courses leading to public health degrees.

This school has set an important standard in establishing for its graduates a certificate of public health (C.P.H.). It is open to all properly qualified students, medical or non-medical; a college or technical degree is a preferred preparation but is not required in all cases. It is to be hoped that courses leading to similar degrees will be established in many universities, on at least the level of the engineering departments, and that such a degree or certificate from a reputable institution will be made a prerequisite for the practice of the public health profession. With wider appreciation of the importance of this profession to the welfare of the state, no doubt such a desirable condition of affairs will be brought about, and the remuneration of expert health officers will become adequate to induce men to prepare themselves in the manner described. For those men who at the present time are engaged in practice as health officers or desire to do so but who cannot take a regular technical course, some of the state boards of health (e.g., New York and Kansas) provide short courses of instruction. One state (New Jersey) requires examination and licensing of health officers and sanitary inspectors but makes no provision for the instruction necessary to pass the examination. Home study (as, for example, of the references given in the present volume) will supply many deficiencies; every health officer owes it to himself and his community to maintain and keep up to date a good though not necessarily a large library on public health, and boards of health should make appropriations for this purpose.

The *administrative qualifications* of the health officer, important though they are, need not be particularly discussed here. Those qualities which go to make a good executive in any department of human activity — ability to judge circumstances, to formulate a plan, and through energy tempered with tact to carry that plan through to a successful conclusion — are likewise here demanded.

Tact is particularly required in the health officer for the reason that he must frequently impose acts and restrictions which are disagreeable to those who are the subjects of them. His quarantines may be against unreasoned opposition and the health regulations may be regarded as arbitrary afflictions; to the property owner he may appear as the instigator of unnecessary expenditure and to the householder as an uncalled-for disturber of comfortable — but objectionable — habit. Such police work is more readily managed in many cases, as every successful health officer knows, by tactful persuasion than by legal measures. In other words the average man can be convinced without much difficulty that to obey regulations is his only prudent course. But tact, of course, means more than this. It means knowing where to go strongly and where to go softly; where to use persuasion and also where, in the residuum of difficult cases, to use compulsion. And all this must be done without losing direction and momentum in the well-defined general campaign which every health officer should constantly be carrying on.

Nature of Work

In small communities the health officer perhaps works single-handed, performing all the executive work of the board of health. Even very small places, however, sometimes divide duties between a "health officer," a physician who attends to the direction of the work and to medical and bacteriological matters, and an "inspector," his assistant, who carries on the routine work of inspections, disinfection, etc. In the larger places the health officer has several assistants who relieve him of the detail and routine work which can be done cheaply and effectively, under his direction, by inspectors, clerks, analysts, etc., leaving him free for the larger responsibilities of expert direction.

The various special classes of service required in the health department staff are as follows:

1. *Inspection Service.* — Inspectors should be trained men having a fundamental knowledge of sanitary principles, though of course not nearly so extensive a training as the health officer. Milk inspectors and other special employees should in addition be specially qualified. Aside from the technical knowledge of the duties of his position the inspector should possess dignity and tact. He must be neither overbearing nor, on the other hand, lenient, neither talkative nor yet taciturn. His words and actions are taken by most persons to be the direct and authoritative expression of the department, and should be accordingly guarded.

Tact in the inspector involves courtesy and common-sense. The two extremes are to be avoided: the inspector who threatens and he who may be persuaded or deceived into passing over improper conditions. In cases of doubt the inspector should not use discretion — dangerous in a subordinate — but should suspend judgment, preserve silence, and report the matter to the "office" for decision.

The inspector, aside from disinfection duties and the like, has two functions: to report on conditions to the health officer, and to bear notices and other communications from the health officer to private persons. No opinion should be expressed by inspectors as to the probable action of the office nor comment be made on such action as may have been taken. All important communications to individuals should be made in writing and from the office. Complaints of an important nature should not be received by inspectors but should be made directly to the health officer, preferably in writing. Of course such rigid rules do not apply to trivial matters which may be set right by a simple oral notification by the inspector, and such notifications should be recognized as a regular part of routine. There are instances in which a mere visit of the inspector

will be sufficiently impressive to produce the desired action, and in such cases formalities are superfluous. Inspectors should thus discriminate, though acting on the safe side in doubtful cases.

The common fault of inexperienced inspectors is to miss violations and to exaggerate those which they do find; the fault of old inspectors, on the other hand, is to grow lax in judgment through becoming accustomed to conditions. To prevent the latter condition it may be desirable to shift inspectors to new districts at not too frequent intervals.

Full-time inspectors should as a rule wear uniforms, which are a distinct advantage in impressing certain classes of people; for part-time men a badge may be sufficient.

2. *Medical Service.* — The board of health must have an official medical representative. His duty consists very largely in making diagnoses in doubtful or suspected cases of communicable disease and in determining whether or not cases are ready for release from quarantine. Occasionally also the " medical inspector " or " board of health physician," as he may be called, may be required to administer antitoxin or perform vaccinations.

Health authorities practically always have the right to investigate doubtful or suspected cases of communicable disease. Thus when there are well-founded rumors that an unreported case of communicable disease exists, when there are " contacts " to be examined or kept under surveillance, or when two or more physicians disagree as to the nature of a case, it is the duty of the board of health to detail its medical representative to make an inspection and decision. It may also be desirable to subject to confirmation the report of the private physician that his case is ready for release from quarantine. And other questions of a similar nature may arise.

If the health officer is a medical man he may naturally perform the duties of medical inspector; if he is not, a

physician, who may or may not be a member of the board, should be designated to perform this function. His position, especially when called upon to decide between the conflicting opinions of other practitioners, requires authority tempered with tact. The board physician may be retained at a fixed salary, or, as seems preferable, may receive a stipulated fee for each visit.

The medical inspector of the board of health should not be confused with the " city " or " poor " physician. The latter is an official of the city government whose duty is the treatment of indigent patients, and he is usually accountable to some municipal body other than the board of health. In such a case it does not seem desirable, although possible, that he act as medical inspector for the board; the functions are quite distinct and there may arise embarrassment in following decisions rendered by an officer not subject to the board's appointment.

3. *Public Health Nurse.* — A comparatively new member of the modern board of health staff is the public health nurse. It is now recognized by progressive authorities that sanitary policing, with its distinct limitations, is not the whole of their duty. Even under the best environmental conditions obtainable by that method there remain ignorance and home conditions springing from it which are a constant detriment to the public health. This fact was first recognized in the tuberculosis campaign, and, later, in the campaign against infant mortality. Tuberculosis patient and mother respectively were sadly in need of instruction in home and personal hygiene, and such instruction was seen to be the most powerful single weapon that could be brought to bear against the twin evils. Hence the institution of the public health nurse.

The first duty of the public health nurse is advice and instruction, with the object of prophylaxis in the individual case: instruction to the mother in the care of her child and to the tuberculosis patient in a proper regime and the

avoidance of spreading infection. Such instruction should be not merely pedantic, but should be combined with encouragement and assistance, the latter to take the form of keeping the patient in touch with charitable agencies, making hospital arrangements, and the like. She may also perform a limited amount of incidental minor nursing work, which should be of great assistance in gaining confidence and impressing her instructions.[1] Finally, she should perform incidental inspection, noting conditions which she may refer to the sanitary inspectors; thus she may readily note matters connected with housing, the keeping of quarantine (though she does not ordinarily enter quarantined families), and the like.

The public health nurse should be a trained nurse, preferably with a social service training such as is now provided in connection with some hospitals, dispensaries and social settlements. The phases of her work will be brought out later under the heads of Tuberculosis and Child Hygiene.

In the work of the public health nurse the health authorities extend their activity beyond the region of strictly public hygiene into that of personal hygiene. Such extension may be justified as demanded by the urgent need of attacking in their very strongholds the great public health problems of tuberculosis and infant mortality. Sanitary policing is of little value so long as uninstructed and unsupervised consumptives spread germs in their families and among their associates in a way beyond such policing. The majority of tuberculosis patients cannot

[1] The public health nurse should be distinguished from the "district" or "visiting" nurses, maintained by charitable societies, whose work consists almost entirely in nursing care. The public health nurse should maintain constant coöperation with such nurses and refer to them any of her cases which need special nursing attention. See Waters, "Visiting Nursing in the United States" (Charities Publication Committee, 105 East 22nd St., New York City), which treats of both classes of work.

and need not be confined in hospitals; hence their home life must be regulated through proper training. Again, regulation of milk supplies is only a partial measure of control of infant morbidity and mortality, and should be supplemented by instruction of mothers to the end that they may properly regulate the equally important matters of feeding, clothing and other care of the infant and the ventilation and cleanliness of the home. There is such a widespread need of such instruction and such beneficial economic and social results follow it that it may well be made public. Both of these lines of attack, through the public health nurse, were first taken up by private organizations — against tuberculosis some years ago, against infant mortality more recently — and now that their feasibility as public health measures has been demonstrated they are due to be taken over by the public authorities.[1] When this is done the idea of charity should be excluded.

4. *Laboratory Service.* — Every board of health requires laboratory service, and the laboratory should be near at hand. If it is necessary to send samples of milk and water and diagnostic specimens to a state laboratory at a distance, there are necessarily inconveniences, disadvantages and even inaccuracies involved. The importance of prompt reports on diphtheria cultures, for example, is obvious. Laboratory work may wholly or in part be performed by the health officer, or it may be performed by

[1] Even where the health authorities cannot as yet command the funds to maintain one or more public health nurses, they may, by conferring upon those privately maintained, the appointment of special inspector, with right to wear a badge, give them a valuable prestige and secure closer coöperation. Where this has been done it has proved a practical preliminary to assuming public maintenance of the nurse. In such a case the nurse acts only incidentally as inspector, so that practically the health authorities do not assume to control her general activities and there need be no conflict on that point. It scarcely needs be said that the private organization employing the nurse must be convinced of the desirability of this step and should make formal application for it.

a private bacteriologist by special arrangement, but in places where there is any great amount of it a bacteriologist and chemist should be employed. Some points in connection with small board of health laboratories are taken up in Appendix D.

5. *Veterinary Service.* — In connection with supervision of milk supplies and of slaughtering, and in the control of communicable diseases among animals, the board of health may appoint its own veterinarian. Examinations of dairy cattle by the official veterinarian are more satisfactory than the reports of private veterinarians, though the former plan may mean a considerable expense to the health department.

6. *Labor.* — The board of health requires a certain amount of service in the shape of labor, clerical and manual, more or less expert. This head includes office clerks; also laborers who may be employed in abatement of mosquito-breeding places, and the like.

7. *Legal Counsel and Service.* — Law, next to sanitation, is the subject on which the board most frequently requires expert advice and service. The board usually appoints, therefore, a counsel or attorney. His duties consist in giving advice on all sorts of legal questions, the criticism and drafting of ordinances, resolutions and forms, and the trying of cases. He stands outside of the regular organization of the staff, and is commonly employed on a salary rather than a fee system. Frequently this work is taken care of by the regular town or city attorney, though some boards appoint their own counsel. Though he should not be a member of the board, the presence of the counsel at board meetings is indispensable.

Aside from counsel, it is essential that the health officer himself have a thorough understanding of the main principles of the sanitary law and of the state and local laws under which he must work. Some of the legal principles underlying board of health work are discussed in Part II, Chapter 7.

The office of the board of health should be conducted like any well-ordered business office. It should be readily accessible to the public and convenient office-hours should be kept, provision being made for receiving bacteriological specimens at all reasonable hours — say until 5 p.m. or even later. In the larger towns a clerk should be employed to take charge of the office while the health officer is out, and to answer questions, receive telephone calls, issue permits and attend to the general routine. The office should be open for one or two stated hours on Sundays and holidays. In order to attend promptly to communicable disease and to receive instructions, sanitary inspectors should report to the office at appointed hours, say at 8 a.m., 1 p.m. and 4.30 p.m. Modern recording devices should be installed, e.g., card catalogs for shifting records and indexes. On account of the possibility of misplacing cards, book records are probably superior for permanent serial records, such as those of births, marriages and deaths and communicable disease. All such records should be kept in safes or vaults. Notices and letters should be typewritten and duplicates kept on file. An office rail for the separation of visitors is a desirable feature.

The health officer's library should include such standard works as are referred to in the present volume, and should be kept quite up to date by the purchase of new and authoritative volumes. Among periodicals the American Journal of Public Health[1] is indispensable; current numbers and bound volumes of previous years should be kept for reference. Bulletins published by various state and municipal departments of health may ordinarily be obtained regularly on application, as well as several of the Federal publications — e.g., the Public Health Reports, Bulletins of the Hygienic Laboratory, monthly list of the Department of Agriculture publications, etc.

[1] See p. 98.

THE NATURE OF SANITARY AUTHORITY

The supervision of the public health is based on the general police power of the state, using both terms in their broadest sense. That power involves the right of the state to regulate the conduct of citizens in such a way that their acts or omissions do not materially and unreasonably injure other citizens. As society grows more complex the exercise of that power involves more extended functions. Most of these are prohibitive in character, though some of the auxiliary functions, such as publicity work and the establishment of dispensaries and hospitals, are constructive. The latter have been fostered by the growing coöperation of health departments with organized charities and other social service organizations.

The sovereign power of the state, as expressed through legislature, delegates sanitary functions to certain official bodies and individuals — commonly to boards of health — who thus obtain their powers through statute law. That law is presumed to represent the kind and degree of authority which the people at any time desire to confer on their servants in sanitary administration. It is necessarily granted in general terms which are subject to interpretation by the courts.

Sanitary Powers and their Definition. — From time immemorial powers of an extraordinary and sweeping character have been reposed in sanitary authorities. The arbitrary and summary power to deprive persons of liberty and property, to check wholly or partly commercial operations, and to disturb civic life to any extent deemed necessary to avert menaces to public health, has in the past been commonly conferred upon them. The Courts, in reviewing their acts, have usually given them the benefit of the doubt if there was any defensible ground for the exercise of those large powers. The following opinion exemplifies the traditional attitude of the Courts towards them:

> Their action is intended to be prompt and summary. They are clothed with extraordinary powers for the protection of the community. . . and it is important that their proceedings should be delayed as little as possible. Delay might defeat all beneficial results; the necessity of the case, and the importance of the public interests at stake, justify prompt action.[1]

Such powers were from the beginning based upon public fear in the face of epidemic disease. It has been said by Kipling that a doctor can by raising a red cross in a desert turn it into a center of population, and by hoisting a yellow flag in a center of population turn it into a desert.

That far-reaching powers are still conceded to sanitary authorities is indicated by the opinion (more recent than that just quoted) handed down in the Montclair (N. J.) tuberculin-test case. In this opinion the Court said that "If the life of one child is endangered by the possible communication of tuberculosis through cows' milk extreme prudence may be proper" in the regulation of the milk supply.[2]

Definition of Sanitary Powers

There is, however, at the present time a clear tendency to define the powers of health authorities more exactly and to confine them within closer ordinary limits. This is the logical sequel of a more exact sanitary science. In the process of legal definition the sanitary functions have, it is true, in some instances been extended, but more often they have been curtailed. This more critical attitude of the courts has recently been exemplified in the "dip milk" decision of the Supreme Judicial Court of Massachusetts, by which the power of a local board of health in that state to make and enforce a regulation forbidding the sale of "dip" or "loose" milk was denied. The Court ruled that the general statute under which

[1] Opinion by Justice Wells in Salem *v.* Eastern R. R. Co., 98 Mass. 431, 433; quoted in Massachusetts Manual for Boards of Health, 1899.

[2] See Appendix C.

the board of health assumed to act was not broad enough to give the authority in question. "This statute," reads the opinion, "does not give the board power to make regulations as to all matters affecting the public health. . . . Milk kept in a vessel, as this was kept by the defendant, was not a 'nuisance, source of filth, or cause of sickness,' which gave the board of health jurisdiction to take any action or make any regulation under the [statute]." [1] Thus, although the powers conferred by the statute were very general a strict interpretation was placed upon them by the Court. Not many years ago the right of a board of health to dictate such a rule under such general powers would doubtless have gone unquestioned in the courts.

Other examples of the critical spirit of legislatures and courts are not far to seek. Laws are much more specific than formerly and more frequently mandatory, rather than merely permissive. The reserve powers of sanitary authorities formerly much exceeded their duties; now powers and duties come nearer to coinciding. To get things done it is found necessary to define them and assign them definitely to certain authorities. The precise terms and wide scope of the state and federal "pure food" laws are an instance in point. If the problem is quantitative it is becoming more common to establish exact legal standards, both to facilitate administration and to limit the exercise of authority. Courts now call for expert testimony and discuss fine quantitative points, as in the well-known Chicago Drainage Canal case, in which the question was

[1] Com. *v.* Drew, Opinion dated April 4, 1911, quoted in *The Banker and Tradesman*, Boston, vol. 43, no. 16, p. 921; cf. *Jour. Am. Pub. Health Assn.*, 1911, vol. I, no. 6, p. 466; also discussion by Jordan, *Am. Jour. Pub. Health*, 1912, vol. II, no. 2. A similar decision was later handed down by the Superior Criminal Court of Massachusetts in regard to a rule requiring that fruit exposed for sale be protected from contamination by dust. To obviate the barrier raised by the "dip milk" decision, a statute has since (in 1912) been adopted by the Massachusetts Legislature.

to decide just how harmful sewage from the city of Chicago, discharged into the Mississippi River, was to the citizens of St. Louis who used the waters of the latter for drinking purposes.

All of this indicates that henceforth boards of health must be prepared to show due and full cause for the measures which they take. At the same time, as the court remarked in the Montclair tuberculin-test case, " the action of a local board in adopting measures for the protection of public health will not be set aside by the Court if the board has acted reasonably upon evidence that might satisfy a reasonable man." A certain degree of discretion (e.g., for emergencies) must clearly be allowed to sanitary authorities, and the organic public health law, as interpreted by the courts, is usually capable of flexible application in the framing of ordinances. The Courts simply require that such application be demonstrably justifiable and *reasonable* within the general powers conferred by statute.

ADMINISTRATION

Efficiency in Local Work. — This is not the place to discuss the necessity of keeping public health work entirely free from harmful political influences, of obtaining and keeping efficient sanitary officers, and the like. Merit systems of employment and the consideration of budgets entirely on their merits (movements which are fortunately gaining ground) are matters of the larger question of municipal government as a whole. Something, however, may be said as to appropriations and the ways of using them.

The majority of boards of health in this country are working on appropriations much smaller than thorough public health work calls for. But even so the question may be asked, whether the majority of departments are employing even the limited funds they have to the best

advantage. For until they can demonstrate that they are, they must be judged in some degree unworthy of the trust implied in greater appropriations.

It may be premised at once that the way to spend a small appropriation is not to spread it out thin over the whole possible field of endeavor, but to *concentrate* upon a very few specific problems and those of greatest local importance. Only in this way can results be obtained and demonstrated as the basis for further demands upon the public confidence and the city treasury. But such work must be persistent as well as concentrated. Too many boards of health either range in a desultory way over a scattered and unsystematized field, or else, while usually limiting their activities to the necessities forced upon them, they arise at intervals to spasmodic and spectacular "campaigns" such as "swat the fly," "clean-up," and whatnot. Such an "outburst method" may have some transient results, which, however, very quickly die out unless sustained by continued and systematic administrative effort.

The dangers of exaggeration are to be guarded against. Health officers can be impressive in their statements, reports and appeals without departing from the truth, which is frequently quite as striking as need be. Exaggerated promises lead to work for the sake of superficial results or to practice which is "ultra vires" — that is, exceeding legal powers; while exaggerated reports of results achieved assumes undue responsibility for the health authorities and weakens subsequent requests for funds for work still needed. Public health programs cannot be accomplished in a day, and, once a proper basis is established, steady progress recorded in accurate reports is the only legitimate aim.

The Problems of Small Communities. — Many small communities have a peculiar problem in that they cannot afford to employ an expert, full-time health officer and to

maintain the organization necessary for thorough public health work. Such communities have to depend upon a busy practitioner, whose chief interest is in medical practice, for part of his time, with perhaps an inexpert assistant. Laboratory work is minimized and, it may be, sent to a distant state laboratory. It is true that some part-time health officers with limited means for organization do overcome the disadvantages and render conscientious and effective service to their communities, but in many such instances it is impossible to obtain adequate service in this way.

To meet such a situation the plan of *joint sanitary administration* has been proposed. Under this plan several contiguous communities, too small to afford expert health service, unite in the employment of a trained health officer and the maintenance of a joint health office. Thus can be secured the services of a full-time competent and properly salaried officer who combines and systematizes the work of the various communities in such a way as to give them adequate service with little or no increase in appropriations, or at any rate at the lowest economical cost. A joint laboratory would be maintained, with a bacteriologist whose concentrated expert services would be preferable to the scattered private examinations which would otherwise be necessary. There would be either joint inspectors, or, if preferred, local inspectors directed by the joint executive. It is interesting to note, in passing, that the same principle has been widely applied, with success, in another field — that of education — in the consolidation of rural schools, by which all the schools in a district are placed under a single superintendent and system maintained and controlled jointly by the communities concerned. Coöperative public health administration is one of the most important of modern developments, and promises to solve the problem of efficient but economical service for all small communities which can and will join forces for

mutual benefit.[1] Of the problem of the more rural districts something will be said in the following chapter.

REFERENCES

Reports of the Committee of the American Public Health Association on Organization and Functions of Municipal Health Departments, published in *Am. Jour. Pub. Health*, 1912 and following years.

Blanchard, "Modern Board of Health Methods in a Small Town," and Gunn, "Modern Board of Health Methods in Small Cities," *Jour. Am. Pub. Health Assn.*, 1911, vol. I, no. 5, pp. 369, 373.

[1] Such a plan is in effect at the present time at Wellesley, Mass., including several of the neighboring towns. It was outlined in a paper by E. B. Phelps, "An Experiment in Public Health Administration," *Am. Jour. Pub. Health*, 1913, vol. III, no. 9, and is reported upon in full by him in *Public Health Rpts.*, Sept. 25, 1914, vol. XXIX, no. 39. For a summary of this important work see Appendix F of the present volume. A certain degree of coöperation on a similar principle has also been established between the Board of Health of Montclair, N. J., and some neighboring small towns. At Wilmington, N. C., a consolidation of city and county boards of health has been effected.

CHAPTER II

STATE HEALTH AUTHORITIES

Just as local health authorities care for public health among the individuals which compose the local community, so state authorities exert power in those matters which are common to communities throughout the state. State health departments represent a later form of organization than the local, having been called into existence by the natural development of sanitary questions of state-wide import.

Originally, as shown by the creative statute of Massachusetts (which had the first state board in the United States), the functions of the state board were entirely *advisory* in character; the board was to " make investigations," " gather information for diffusion among the people," and make " suggestions as to legislative action." This is still, perhaps, the most important function of state boards of health. But of recent years there have been added, according to the exigencies of state-wide action, certain functions of an *executive* nature. These are exemplified in supervision of foods and drugs, of water-supplies, and of sewage disposal, and in the comprehensive registration of vital statistics. And the executive sphere of state action will doubtless continue to increase.

On the other hand limitations and conservative policies restrain state health authorities from interfering in matters which can be dealt with by the local authority, except when these have a truly state or *inter-community* bearing, i.e., when other districts than the one in question are injured

or threatened. There is a tendency at the present time to keep the degree of supervision of the state over local boards of health very slight, too slight, in fact, in many instances, to insure the maintenance of proper minimum standards by those boards.

ADVISORY FUNCTIONS OF STATE AUTHORITIES

Under the head of advisory functions state health authorities maintain the following classes of activities.

1. **Investigation.** — Progressive state departments carry on various kinds of research — laboratory, statistical and in the field — such as experimental work in bacteriology and chemistry in their sanitary applications, statistical and field investigations of conditions and administration throughout the state, and the like. A great deal of the information gathered is used in public enlightenment and in advice to local boards of health.

2. **Expert Advice and Information to Local Boards of Health.** — Problems in the control of *communicable disease* constitute the largest class of matters concerning which state advice is sought. Such service is invaluable in connection with epidemics, as also when a rare disease appears. Local authorities show wisdom in seeking state coöperation in any situation which is difficult or which threatens to become so. Such a move does not signify local incompetence, but prudence. Every state department should have in its staff trained epidemiologists, specialists who are much more expert in dealing with the unusual aspects of communicable disease than the local health officer can possibly be, and to seek their services is frequently wisdom on the part of the latter. This is especially true in the smaller towns, where experience of communicable disease is limited. Frequently application for a state inspector in the early stages of an epidemic in such a town will result

in obtaining advice which will clear up a situation which might otherwise have resulted disastrously. In case there is public apprehension, resistance or criticism, they are abated in the presence of state authority. The state inspector, furthermore, will recognize the larger aspects of an epidemic: e.g., the possible danger of spread of the infection to other communities through milk-supplies or by the traveling of infected persons. It is for such reasons that cases of communicable disease occurring on dairy premises or among dairy employees should be dealt with by the state authorities; in some states the law requires that they be so controlled.

Under the head of *laboratory service* to local boards, bacteriological service in the diagnosis of communicable disease, when the local board has no facilities, is usually furnished. Thus boards of health and physicians in small places may transmit cultures of diphtheria, etc., to the state bacteriologist for examination. This procedure, as already remarked, is by no means ideal, yet may be the best available.

Other valuable laboratory service to local boards is frequently provided; thus in some states diphtheria antitoxin, Pasteur treatment for rabies and other sera are furnished. In the same way samples of water and foods (especially milk) may be analyzed for the local authorities, with advice on the analytical results. Some state boards provide outfits of prophylactic solution for free distribution to physicians and midwives for the prevention of ophthalmia neonatorum (see p. 240).

Special questions somewhat beyond the province of the local counsel — on legal procedure, proposed ordinances, powers and the like — may be submitted to state health authorities or state attorney-general for advice. The state authorities should have a close familiarity with the statutory health powers and with the ordinances adopted by the various local boards of health and how these have

worked out in practice and before the Courts; and should consequently be able to render effective advice on all such matters.[1]

3. **Coöperation with Local Authorities in Raising Standards of Administration.** — State departments are in a position to *standardize methods and forms* and to devise plans for uniform composition and reporting of certain data, especially statistical data. There is unquestionably a great deal of confusion and ineffectiveness among local boards which might be removed by such means. Without the repression of the experimental and practical divergencies which must necessarily and properly exist among local boards, a common agreement upon the main results to be aimed at, the principal recognized methods of attack and the terms in which results are to be expressed is one of the chief needs of the present day.

A most important opportunity of state departments consists in arranging for *state conferences* at which the health officers from the various communities meet for reading of papers and discussion of the many pressing questions arising out of their work. Such conferences have been

[1] As an example of effective information to local authorities we may mention the valuable "Public Health Manual" issued by the New York State Department of Health for the guidance of local health officers and boards. It contains not only the public health law, but also model sanitary regulations, instructions to health officers and to registrars, instructions regarding the various communicable diseases, and other useful matter relative to state and local boards of health. Bender's "Health Officer's Manual and Public Health Law of the State of New York" supplements this, containing annotations on the law, an explanation of powers and duties of local health authorities, recommended sanitary regulations, state department information for officials and private individuals regarding communicable diseases, and forms (pub. Bender and Co., Albany, N. Y.). The Manual of the Laws relating to the Public Health, issued by the Massachusetts State Board of Health, fills a similar need in collating laws and court decisions. Such studies and codifications of the health laws are highly useful and should be available in every state.

held with excellent effect in New York, Connecticut, New Jersey and other states. At least an annual, and preferably a quarterly, conference should be held in every state. Conferences may be held not only at the state capital, but also at various convenient points in the state. Each health officer should have a general authorization from his board to attend such conferences, and legislative provision should be made that each municipality pay the necessary expenses of its health officer (and perhaps certain other employees) incurred in such attendance. At such conferences peculiarly local problems are discussed and invaluable opportunity afforded local officers to meet the state officials and one another. We may add that experience has shown the advisability of forming a state health officers' association, which coöperates with the state health authorities in calling conferences, arranging programs for them, and stimulating interest on the part of the local officials.

State authorities have an important duty to perform in endeavoring to raise the professional standard of health officers and inspectors. This it may do by obtaining through legislation a *minimum legal standard for the qualifications of sanitary officers*, and by providing for the *instruction* of such men (either practicing or as candidates for office) as may be deficient in any subjects. The State Departments of Health of New York and Kansas, for example, maintain regular courses for health officers in sanitary science and laboratory practice.[1] In New Jersey there has been in operation since 1904 a law requiring that all health officers and sanitary inspectors practicing in the state hold a license from the State Board of Health, such license to be granted only upon passing written and oral examinations. This particular plan has certainly improved the average qualifications of local

[1] It has been suggested that good results might be obtained from correspondence courses (Trask, in *Pub. Health Rpts.*, Sept. 4, 1914).

officers through the elimination of unfit candidates. It is based upon a good principle and would yield much better results were it not for two serious obstacles. One of these is the lack, in that State, of means of instruction for actual or prospective sanitary officers; the other, more deeply rooted, is the failure of many municipalities to pay a sufficient salary to induce such officers to prepare themselves by adequate study for their positions. In this pass, since there is an insufficient number of properly qualified men and the state authorities cannot therefore reasonably attempt to force local communities, the law is only partly fulfilled. Nevertheless, it points the way to a truly effective system of qualifying and licensing health officers and inspectors.

Some state departments maintain a *bulletin service*, one of the objects of which is to keep in touch with local health officers and boards on matters of administrative interest. (The bulletin as a means of publicity will be spoken of later.) Such a bulletin is a very important factor in raising and supporting high standards and in disseminating important information and advice. Changes in the health laws, new regulations promulgated by the state health department, ordinances of special interest adopted by local boards, advances in sanitary science and practice, the communicable disease situation, and many other matters are by this means presented fresh to the local official. Subjects which have been or will be discussed in conferences may be introduced and important papers presented at the conferences may be printed. Concise abstracts of articles published in various professional periodicals and the like may be printed for the perusal of the busy health officer. The Departments of Health of New York, Massachusetts, Virginia, Kansas, North Carolina, California and other states maintain such bulletins with excellent effect. However much popular matter or statistical tabulations such a bulletin may con-

tain, a generous share of space should be allotted directly to the interests and needs of the local board and health officer.

4. **Coöperation with Universities.** — Opportunities for mutual benefit lie in coöperation of state health departments with educational institutions which carry on work in sanitary science and public health. The plan has been adopted, with some success, between state boards and state universities, in some of the states. While as yet the idea is in a tentative stage, there are undoubtedly advantages in such coöperation under favorable circumstances.[1] Under such an arrangement the state health authorities may be enabled to profit by the services of expert university specialists, to obtain more extensive research work than otherwise, and to have the use of well-equipped laboratories and libraries without great expenditure; while the university instructors have the opportunity for research and service in practical fields, and the university students for study of professional practice and problems at first hand.

5. **Publicity.** — In publicity work state health departments have a wide and important field. The *newspaper press* deserves special mention as being the most powerful means of publicity today. A great deal of the data collected by state authorities can be worked up into readable, and at the same time educative, press material instead of being simply filed away in official reports or even bulletins. Those state health departments which carry on a regular, active press service for the newspapers are taking by far the shortest route to the public mind.

Many state health departments issue for popular instruction *printed matter*, such as bulletins, circulars, posters and the like. We have mentioned above some of the states

[1] See discussions by representatives of several states before the American Public Health Association in 1910 (*Jour. Am. Pub. Health Assn.*, 1911, vol. I, p. 544 ff.).

which issue effective periodical bulletins. Such a bulletin usually has two objects in view: the benefit of the local health officer and the benefit of the public. The former object has already been mentioned above. It seems advisable that so far as possible the two classes of matter be printed and circulated separately, some going into the bulletin for health officers and some into popular bulletins and an active press service.

The annual reports of state boards of health contain much matter of interest, but such reports are usually more or less delayed and a great deal of the matter would be of greater effect if issued more promptly in the shape of press news bulletins, and the like.

Popular exhibits constitute part of the publicity arsenal of some state departments. Thus the New Jersey State Board of Health maintains a traveling tuberculosis exhibit which is successfully shown in various towns under the auspices of the local board of health, school authorities, anti-tuberculosis society and other organizations. In California and other states exhibit-cars have been fitted up and put on the road for short stops in out-of-the-way places which it would be impracticable to reach otherwise. Exhibits, moved from place to place, stir up local interest and stimulate local action, and are therefore highly valuable factors in the leadership of the state departments in campaigns against tuberculosis, for improved milk supplies and the rest.

EXECUTIVE FUNCTIONS OF STATE AUTHORITIES

State authorities may exercise executive power when a condition existing in one sanitary district affects another district, or when the matter to be dealt with affects two or more districts in common and is best administered by central authority. The various executive activities of state authorities may be summarized under the following heads:

1. **Communicable Disease.** — When cases of a transmissible disease threaten more than one sanitary district, state authorities may have power to institute general quarantines and to perform other such executive functions. The control of communicable disease on or affecting dairy premises (where the infection might be transmitted to citizens in another and perhaps far-distant part of the state) is an example of the exercise of such power.

2. **Nuisances.** — When a nuisance located on one sanitary district affects another district, the state authorities may have executive power to order abatement, and if necessary, to institute legal suit.

3. **Registration of Vital Records.** — The maintenance of a thorough and comprehensive system for the registration of records of *births, deaths and marriages* is the chief duty of the state health department.[1] No efficient system can be obtained without strong central control, a fact which has now been recognized in many of the states.

The function of the *state registrar* consists in:

(1) Inspection of certificates received for the detection of inaccuracies and deficiencies which may have escaped the notice of the local registrar.

(2) Filing for permanent legal record and for statistical purposes.

(3) Statistical tabulations and study. As regards sanitary administration, the publication of good statistical reports and studies is the final aim.

The collection of morbidity records (i.e., records of sickness) is another duty of the state authorities. The movement in this direction is of comparatively recent but promising development. Local health officers are required to forward at short intervals to the state depart-

[1] This duty may be lodged with some other department of the state government, but it seems altogether most desirable, for reasons which will be set forth later, that it should be under the department of health.

ment, not necessarily to the state registrar but rather to the division of communicable diseases, statements of the local numbers (and sometimes detailed data) of cases of communicable diseases. (The requirement may also embrace occupational diseases, epilepsy and other diseases reportable by physicians.) The incidence and distribution of the cases are noted and studied in various ways. They may form the basis for investigation, advice or warning in case of unusual local conditions in any instance. The mortality records may also be used as a check on the completeness of registration of communicable disease, and action may be taken to keep the local authorities up to their duty in this respect.

In the development of systems of registration of vital records (using that term in the broadest sense), state departments of health have large responsibilities and opportunities. At the official head of the movement for better mortality statistics is the Federal Bureau of the Census, which endeavors to obtain completeness and accuracy in the returns throughout the country, as shown, for example, in its distinction between "registration" and "non-registration" states. In this work it is supported and assisted by the U. S. Public Health Service, the Vital Statistics section of the American Public Health Association and other organizations. In this work the individual states through their departments of health and their registration officers, play a most important part. The divergences among the various states in laws and methods are wide, but at the present time efforts are being made to obtain uniformity in all essentials. Such efforts involve the establishment of national standards which should eventually be universally adopted throughout the country.

The requirements for an efficient state registration system may be summarized as follows:

(a) An adequate state registration law, including among others the following provisions.

(b) Uniform blank forms, based upon the best statistical practice, prescribed for use throughout the state.

(c) Legal requirement that the local registrar be an officer of the local board of health, rather than the town clerk or other official.[1]

[1] In New Jersey a bill was introduced in 1913 (by request of the State Health Officers' Association) providing that a local board may appoint a registrar who thereupon is entitled to full charge of records

(d) Legal provision for sufficient pay to such registrar, either by salary or fees, to compensate for efficiency in the performance of duty.

(e) Insistence by the local registrar on prompt filing of all certificates and on fullness and accuracy in the same.

(f) Accurate local transcription and checking of certificates, and periodical forwarding of them, as should be required by law, to the state registration office, a bureau of the state department of health.

(g) Finally, systematic watchfulness on the part of the state registration authorities over the accuracy and completeness of local returns, and the power on their part, not only to ensure the performance of duty by local registrars, but also to bring suit themselves, if need be, against physicians and others responsible for making returns.

All of which, it is evident, depends largely upon the activity and vigilance of the state authorities.

4. **Food and Drugs.** — The enforcement of the complex and far-reaching food and drug laws is best managed by the state department of health with its expert inspectors and analysts, its special laboratories and its experience over a wide area. The state laws on the subject, it may be noted, are largely patterned after the Federal Pure Food Law. This is fortunate, for differences in the state standards in this intricate matter would at once lead to confusion and impaired authority. State officials investigate conditions as to manufacture, storage, transportation and distribution, and collect samples for analyst. State licenses may be required for certain classes of establishments, such as bakeries, ice-cream and confectionery factories, and the like, which may, however, be required to conform to local regulations as well. Through such state activity local boards of health are not curtailed in their authority, but are relieved of a good deal of specialized work of a state-wide character, which they are commonly unable properly to perform for themselves.

of births, marriages and deaths, relieving the town clerk or recorder of that duty. The bill was made permissive in order that only those boards appreciating the responsibility and prepared to take proper care of the records would assume charge of them.

Altogether this constitutes one of the most effective branches of state executive activity.

In the supervision of milk-supplies, state control has a special value in relation to dairies and creameries which ship from one part of the state to another. The state authorities can readily supervise widely scattered dairies as well as the conditions in transit. Later, under the head of milk-supplies we shall revert to this point in some detail.

5. **Water Supplies and Sewage Disposal.** — Arbitrary powers of approval or disapproval of the water-supplies of municipalities, as based upon sanitary investigation, may be conferred upon state boards of health. Thus, for example, in Massachusetts, which has one of the oldest and most comprehensive laws on the subject, the State Board of Health may make rules and regulations for the protection of water-supplies, and no municipality may introduce a new system of water-supply without the approval of the Board. The Board has corresponding powers in relation to sewage-disposal throughout the State. Thus also the Engineering Division of the Michigan State Board of Health, created in 1913, has supervision of all sewer and water systems in the State, has power to deal with stream pollution, conducts investigations of water-supply and sewerage, including trade wastes, and gives advice to municipalities.

6. **Factories, Tenements, etc.** — State boards of health usually have at least general powers of inspection and sanitary control of factories and tenements, and sometimes of schools. This function includes also sanitary supervision of the public institutions of the state, such as prisons, hospitals, etc. In Massachusetts, for example, factory and other inspections were until recently[1] performed by a body of State Inspectors of Health under the State Board of Health, their investigations being published in a series of annual reports. Owing, however, to the specialized

[1] Transferred in 1913 to the State Bureau of Labor and Industries.

nature of tenement and factory inspection and to the fact that the questions of safety as well as health are involved, there is a tendency to assign these matters to special departments of the state government distinct from the health department, while matters of school hygiene are being left more largely to the educational authorities.

7. **Transportation and Marine Quarantine.** — Writing in 1900 on the status of public hygiene in the United States, Dr. Abbott (in a monograph for the U. S. Commission to the Paris Exposition) remarked of railway sanitation:

> At the present time almost the only legislation on this subject is that which exists in a few states in relation to the transportation of dead bodies, and specially regarding the bodies of those who have died of infectious diseases. Yet, it is a matter of certainty that a living, breathing human being, sick with an infectious disease, is a far greater danger to persons in his immediate proximity, than the body of one who has died of the same disease, and is enclosed in a coffin. . . . Legislation intended for the protection of the traveler from the sick and living is of far more importance than that which is designed to protect him from the dead.

Now, fortunately, broader views are taken of the hygiene of transportation than those entertained by the state authorities and legislators of that date. Sanitation on board trains and boats and in railroad stations; the abolition of the common drinking cup and towel in trains, stations and other public places; the sanitation of roadbeds in relation to the spread of disease through the dropping of excreta (particularly through the pollution of watersheds through which railroads may run); regulation of the care of milk and other foods in transit; restrictions on the transportation of infected persons; and other related matters are now recognized — or beginning to be recognized — as responsibilities of the state health authorities. The oversight of the sanitation of construction camps on railroads is a duty of the same class.

The quarantine of ports of entry in maritime states is sometimes assigned to state authority, although this is a

matter varying from state to state, in which the municipal government of the port and the Federal Government may also have a share.

8. **Manufacture of Antitoxins and Vaccines.** — The state health authorities should properly have supervision over the manufacture of all antitoxins and vaccines produced in the state. Actually, most if not all such establishments engage in interstate trade and are therefore subject to supervision by the Hygienic Laboratory of the U. S. Public Health Service. In order to provide reliable antitoxins and vaccines, at low cost, for local boards and private sale, the state health department (as now in several states) may by special legislative authorization undertake the manufacture and distribution of diphtheria antitoxin, smallpox vaccine, typhoid vaccine, Pasteur rabies treatments and other products of this class.

9. **Hospitals and Sanitoria.** — The duty of establishing and operating, or at least of supervising, hospitals and sanitoria for tuberculosis and other diseases may be assigned to the state health authorities. Frequently, however, such duties are assigned to a separate state department or to the counties.

10. **Local Executive Action and Supervision over Local Authorities.** — In exceptional instances the state authorities may exercise purely local power in place of that of the local board of health. Thus, in New York State, if a municipality fails to establish a board of health, the state commissioner is authorized to act instead, appointing a health officer and fixing his duties and compensation, the latter being paid by the municipality. Again, in Indiana, the state board of health is empowered to remove local health officers for incompetence. In Massachusetts the state board has coördinate powers with the local board. Powers overruling those of the local authorities are, however, reserved for unusual circumstances, as are coördinate powers, which moreover may result in division

or clashing of authority. The usual way for state authorities to stimulate and assist local authorities is through coöperative advice, and such powers as they may hold over the latter are properly designed chiefly to insure a minimum degree of activity.

An instance of state action in local affairs for the protection of the people of the state in general may be seen in New York. There serious problems are found in summer resorts, where certain unsanitary conditions exist as a detriment to vacationists coming from other places. The great increase in population in such places during the summer months is in itself a serious matter, meaning increased problems of water-supply, milk-supply and the disposal of wastes. Such problems the local authorities perhaps cannot or will not cope with. The New York State Health Department has opened up a promising line of attack in making a survey of all summer resorts in the state and publishing in its monthly bulletin or in the newspaper press the names and locations of those establishments which fail to comply with repeated orders to eliminate unsanitary conditions. While such action is not strictly executive, it has much the same effect in taking the place of local action.

There is a sentiment in some quarters that state health authorities should exercise a greater degree of supervision over the activities of local authorities. If the state department is thorough and alive to the best practice, some sort of regular inspection service to insure adequate local organization and methods is very desirable. In New York State (see below) such supervision goes so far as to take over the functions of the rural local boards, the latter being abolished.

In the performance of its executive functions the state board of health acts in the same manner as the local board: it has the power to make regulations, to inspect and examine, to deliberate, notify, warn, advise, and, finally, if necessary, to institute legal proceedings.

STATE ORGANIZATION

In general two different forms of state organization exist, according to whether the supreme power is vested in a *board* or in a *commissioner*.

In nearly all of the states the former is the case. Thus in Massachusetts, where the earliest state board was established, that board consists of " seven persons, one of whom shall be annually appointed by the governor, with the advice and consent of the [governor's] council, for a term of seven years." The members serve without compensation (though this is not the case in all states), and the board has long been noted for its high personnel. Such a board must of course have an executive officer, analogous to the local health officer, to direct the work of its staff. This officer is usually the " secretary," though sometimes the president of the board or a specially appointed " health commissioner."

The second plan is well illustrated in New York State, where a radical change was adopted in 1901, confirmed by the reorganization law of 1913, by the abolition of the state board of health and the substitution of a state " commissioner of health " having all the powers and performing all the duties of the former board. For his guidance and support, the New York Commissioner has the assistance of an Advisory Council consisting of two laymen, one sanitary engineer, three physicians and the commissioner. In Pennsylvania a similar plan, with even more local power, is in operation. The New York plan combines the advantages of concentrated executive control with the stability of a competent deliberative board.

Attention has recently been called[1] to the predominant influence which the medical profession has exerted and still exerts in state (as well as local) boards of health. Although that profession has unquestionably played a

[1] See footnote p. 14.

large part in the development of public hygiene, and should have a representation on every such board, nevertheless hygiene has widened and become more and more specialized until we can see that several other classes of men are needed on our health boards. The founder of modern public health science — Pasteur — it must be remembered, was not a physician, but a chemist, biologist and bacteriologist; and he has been followed by a company of other specialists in those sciences, as well as by sanitary engineers and social workers who have done much to further the public health. It is interesting to note that such facts were taken into account by the far-seeing State Sanitary Commission of Massachusetts over sixty years ago when it recommended that the state board include, besides two physicians, "one counsellor at law, one chemist, one natural philosopher, one civil engineer and two persons of other profession or occupation, all properly qualified for the office." And the importance of representation other than medical has increased since that time, for, as the public health specialist develops, the need for the medical man lessens. As for the chief sanitary executive of the state, while strict requirements as to professional training and accomplishment should be upheld, requirements that he be necessarily a physician might well be abolished, while professional sanitarians and others who in any proper way have achieved the requisite qualifications as sanitary administrators are entitled to an equal chance.

Details of organization and procedure, differing as they do from state to state, need not be taken up here. Every well-organized state health department has, working under its general administration, divisions (actually if not nominally) of vital records, of communicable disease, of general sanitary inspection, of foods and drugs, of water-supplies and sewerage, and of publicity, and the necessary accessory laboratories. It relies upon the attorney-general and legal department of the state for legal advice and services,

and may coöperate to a greater or less extent with the state educational authorities, agricultural or livestock authorities and others whose activity bears in any special way upon the public health of the state. The Massachusetts Department has a corps of Inspectors of Health, each resident in a district, who carry on investigations and furnish advice to the authorities of local communities. The New York plan of state supervisors for rural districts is described below.

State Sanitary Supervision. — Of recent years growing attention has been paid to the inadequacy of the sanitary service in rural districts throughout the country. This attention comes late, for, while the cities have been forced, by the conspicuous and obviously pressing nature of their public health problems, to make some sort of provision for health service, in the country districts the problems have not been so concentrated and apparent. Nevertheless it is now a fact familiar to those familiar with the conditions that rural health administration in this country is to a large extent inadequate, both as to funds and as to the methods of their expenditure.

Statistics show that death rates in the rural districts are not decreasing equally with those in the cities, and in some cases are actually stationary.[1]

Moreover, conditions in the rural districts do not affect those districts alone, but have a pronounced bearing upon the health of the towns and cities and constitute a state-wide problem. This is clear when we consider the inter-

[1] "The January [1914] number of the State Charities Aid Association News, New York, prints an interesting chart comparing the fall in the death rates from all causes of New York City and Rural New York State (villages of less than 8000) for the period 1900–1913. During this time the city rate fell from 20.6 to 13.7 per 1000, while the rural rate changed from 15.5 to 15.4 per 1000. Because of this showing the State Grange recommended to the State Commissioner of Health that a division of rural hygiene be added to the State Health Department." — *Jour. Outdoor Life*, April, 1914.

communication, both of persons and of commodities, between town and country, which modern organization and transportation facilities have made possible. Thus the transportation of milk and other food supplies from rural to urban districts — regular, great in volume and rapid in transit — constitutes an open channel for the infections which occur in country districts. Again, deficiencies in rural sanitation may endanger city water-supplies drawn from surface sources in the country. And again, the interchange of persons between city and country, which is now very frequent — country people visiting the city and city people spending their long vacations and even their short holidays in the country — favors the interchange of infections.

The fact, alone — that the flow of potentially infected food-supplies is from the country to the city and from single points in the country for wide distribution in the city — overshadowing other considerations less clear and apparently less important, indicates that on the whole the city has the worse side of the bargain. And this is true in greater degree in instances where insanitation prevails in the country and at least fairly good sanitation in the city.

Nor does criticism of rural districts apply only to strictly agricultural regions. It includes also many small towns of an industrial or semi-industrial character, grouped, frequently, about a small factory, — communities which have not yet attained to the growth and organization of cities but which have typical urban problems without the remedies of urban sanitary control. It is concentration of population, not the mere size of the settlement, that constitutes the real problem.[1] In many respects these nascent con-

[1] The sanitary characteristics of communities of different sizes have been compared in a study by W. T. Sedgwick, G. R. Taylor and the present writer: "Is Typhoid Fever a 'Rural' Disease?", *Jour. Inf. Diseases*, 1912, vol. XI, no. 2, p. 141.

centration centers present the most serious sanitary problem in America today.

Under present organization it cannot be expected that there will be much immediate improvement in rural sanitary administration especially as rural communities themselves are content with conditions as they are. The plan of joint sanitary administration outlined in the last chapter applies only to the larger and more developed towns and then only under favorable circumstances. Furthermore, it is interesting to note that in the field of education, where consolidated rural school districts have been established for the purpose of increasing efficiency, experience has shown the need of generally centralized control of rural administration, the county being indicated as the proper unit.

The New York State Plan

Great promise of the solution of this problem is now held forth in the recently adopted New York State plan. The State (except New York City) is divided into twenty districts each of which is placed in control of a "sanitary supervisor," who oversees the work of the health officers and is himself responsible to the State Commissioner of Health. The latter, with the assistance of his Advisory Council, may promulgate a sanitary code to apply uniformly throughout the districts. The Supervisors are independent of local influence and interference; they are experts giving their full time to the work and subject to no local control. The most primitive country community has the benefit of the most advanced methods of public hygiene. Furthermore the costs of supervision can be arranged to fall upon the state as a whole, so that the large cities (which, as already explained, derive a special benefit) pay their share. The pay of local health officers has been placed at a minimum of ten cents per capita per year in places of 8000 population and less.

It appears that sanitary administration in future will be

much more centralized than at present. Such has been the experience of older countries, such as England, in their development. In other states plans similar to the New York plan have been proposed. The latter promises to prove the greatest single step forward in organization since the establishment of sanitary authorities in this country. If it brings forth the results now confidently expected it will undoubtedly be adopted, at least in principle, in other states.

CHAPTER III

FEDERAL HEALTH AUTHORITIES

The Federal authorities bear somewhat the same relationship to those of the States that the latter do to the local boards of health; in other words, their functions are properly either interstate or related to the Union of States as a whole and are not exercised except under conditions which cannot be effectively dealt with either by local or by state authorities. This is in accordance with the provision of the Federal Constitution that powers not expressly delegated by that instrument to the Federal Government are reserved by the individual states to themselves. Viewing the national public health scheme as a whole, the bulk of the executive power is lodged with the local boards of health; less with the state boards of health, which are therefore more advisory and less executive; and still less with the Federal Government, which is most advisory and least executive.

ADVISORY FUNCTIONS

Most of the advisory activity of the various Federal public health agencies is of a general nature. A great deal of *investigation* — consisting in laboratory, statistical and field work — is carried on as a basis for information which is distributed through the medium of printed reports for the benefit of the country as a whole. The collection of vital statistics on a nation-wide scale is an especially important activity of this kind. The facilities possessed by the central government and its wide range of territory make possible the prosecution of researches which would be beyond the resources of single states, while at the same time

unnecessary duplication among the latter is avoided. In all of this, however, there is coöperation with state and sometimes with local departments of health.

General information and advice, then, directed both to public officials and bodies and to citizens, is the main channel for the dissemination of the valuable results obtained by Federal research work.

Particular advice is also an important service rendered by the Federal agencies. Aid on request is given to state authorities — more rarely to local authorities — under unusual circumstances. A constant coöperation is kept up between the states and the Federal agencies. A conspicuous example of aid on request was the assistance rendered by the Public Health Service (then the U. S. Public Health and Marine-Hospital Service) to the State of California when bubonic plague appeared in San Francisco in 1900 — although in that case the Federal officers were seriously handicapped by the strong adverse influence of commercial interests.[1] Other emergencies, such as the insanitary conditions incident to the floods in the Ohio and Mississippi Valleys in the spring of 1913, give occasion for Federal investigation and advice.

EXECUTIVE FUNCTIONS

The executive functions are to be considered, as already suggested, as they relate to *interstate* matters or to *national matters* affecting the country as a whole or over wide areas. Under the former head fall the supervision of interstate transportation (sanitation as to water-supply, etc., on trains and boats), and the supervision over meat and other foods, drugs, sera and other articles which are shipped from one state to another. (Power over the pollution of interstate streams is unfortunately not as yet included in this category.) Under the head of national executive protection is the Federal quarantine system.

[1] See p. 36 of the Memorial cited in footnote to p. 57.

THE FEDERAL BUREAUS

The United States has at the present time no unified national bureau or department of health analogous to the Comité Consultatif d'Hygiène of France, the Imperial Gesundheitsamt of Germany or the Local Government Board of England. The activities carried on by the Federal government for the furtherance of hygiene and sanitation are distributed among several separate and distinct bureaus, as follows:

In the Treasury Department:

The Public Health Service (formerly the Public Health and Marine-Hospital Service), which performs more of the functions of a national health department than any of the other existing Federal bureaus. The Service has charge of the administration of the national maritime quarantine and of the national laws pertaining to medical inspection of immigrants; conducts investigations, in the various states, on infectious diseases, maintaining in this connection a Hygienic Laboratory; and regulates the purity and potency of vaccines, antitoxins and serums manufactured for sale in interstatic traffic. Each year it calls into conference representatives of the state boards of health for discussion of scientific and administrative questions and the promotion of coöperation. It publishes weekly Public Health Reports, for circulation among health authorities and others, setting forth statistical and other data relating to national quarantine, communicable disease and mortality throughout the country, and other related subjects. In 1912 the Service was granted more general authority " to investigate the diseases of man " and the conditions related to them, including in scope "sanitation and sewage and the pollution . . . of the navigable streams and lakes of the United States."

The Hygienic Laboratory of the Public Health Service is conducted in four divisions, viz., bacteriology and pathol-

ogy, chemistry, zoölogy and pharmacology, and carries on a great deal of important research work in those subjects, the results of which are set forth in the Bulletins of the Laboratory.

The Public Health Service, the history of which is a long and creditable one which cannot be detailed here, may rightly then be regarded as the national bureau of preventive medicine.[1]

In the Department of Agriculture:

The Bureau of Chemistry, the principal hygienic function of which is the highly important one of the investigation of the adulteration of foods, drugs and liquors, and the administration of the Federal Pure Food Act.

The Bureau of Animal Industry contains, among other divisions, the *Dairy Division*, which carries on sanitary and economic investigations of the milk industry, and the *Meat Inspection Division*, which inspects meat entering into interstate traffic and the slaughterhouses where it is killed and prepared.

(The Bureaus of Plant Industry and Entomology also publish occasional papers pertinent to public health.)

In the Department of Commerce:

The Bureau of the Census includes the *Division of Vital Statistics*, which collects, analyzes and publishes statistics of population, births and deaths, for the country as a whole and for its various cities, towns and other civil divisions.

In the Department of Labor:

The Children's Bureau, instituted in 1912, which conducts investigations and disseminates information dealing with the protection of child life, particularly as regards prevention of infant mortality.

[1] See Anderson, "Organization, Powers, and Duties of the U. S. Public Health Service To-day," *Am. Jour. Pub. Health*, 1913, vol. III, no. 9, p. 845; also Wyman in Reprint, no. 49, from *Pub. Health Rpts.*, 1910.

Besides the above the Medical Departments of the Army and Navy carry on investigations and make reports on phases of preventive medicine which are not infrequently of wider significance than their titles indicate.

PROPOSED NATIONAL HEALTH SERVICE

That the Federal health conserving agencies lack co-ordination, that the one most approximating a national health department — the Public Health Service — is under the anomalous control of the financial department of the government, and that others are scattered among several departments and bureaus as we have just seen — these facts are the basis of a growing demand for a unified National Health Service to be organized as a Department, or at least as a bureau, of the Federal Government.

There was at one time, in fact, a National Board of Health. It was established by Congress in 1879, just after the yellow fever epidemics in the South, and was authorized to "obtain information upon all matters affecting the public health." This board accomplished much useful sanitary work and started investigations in nearly every department of sanitary work, but through the failure of Congress to continue appropriations it was allowed to lapse in 1884. It was created under the stimulus of the prevailing epidemics and was dissolved with their passing.

From that time to the present there have been proposals for the establishment of a national public health service in the broadest sense, to embrace all of the present agencies, correlate them and enlarge their scope. Several years ago the project was taken up by an organization formed for that particular purpose — the Committee of One Hundred on National Health of the American Association for the Advancement of Science. The demands took on a special vigor with the publication of Professor Fisher's Report on National Vitality and the introduction of the Owen Bill (first introduced in Congress in 1910 and re-introduced

each year since then), and the latter was followed somewhat later by a detailed brief for it in the form of a Senate Memorial.[1]

There have also been plans proposed other than that contemplated in the Owen Bill, and the general object of establishing a national health department or bureau has been widely indorsed, the indorsers including the American Public Health Association, the American Medical Association and many other organizations and persons, private and public. Organized efforts for this object are now carried on from year to year.

In the present agitation the true question relates not so much to the nature of the activities now carried on as to their coördination. The demand for a national health department should not be taken to mean that we have not, aside from questions of organization, a good national health service, for a very brief survey proves the reverse. Cartoons, such as have been published, showing "Uncle Sam" spending millions on the health of hogs and little or nothing to promote the health of human beings, are false and misleading. The difficulty is that the latter class of work is not so obviously organized as the former; being of a more diverse character, it has not yet been corre-

[1] See the following:

"Work of the Committee of One Hundred on National Health," by Wm. Jay Schieffelin, Publication No. 628, American Academy of Political and Social Science, 1911. (The Committee has offices at 105 East 22nd Street, New York City.)

Report on National Vitality; its Waste and Conservation, prepared for the National Conservation Commission by Professor Irving Fisher, Bulletin 30, of the Committee of One Hundred on National Health (Government Printing Office, Washington), 1909.

Memorial relating to the Conservation of Human Life as contemplated by Bill (S. 1) providing for a United States Public Health Service, prepared by Prof. Irving Fisher, assisted by Miss Emily F. Robbins, Senate Document No. 493, 62nd Congress, 2nd Session, 1912.

(The latter two publications may be obtained on application to the Supt. of Documents, Government Printing Office, Washington.)

lated in one department. Nor should the present demand be taken to signify that local and state work is being directly held back pending re-organization at Washington. But the efforts to obtain such re-organization and thus even greater efficiency are evidently based upon sound arguments, and, when questions as to the particular form of re-organization shall have been settled, will doubtless gain the desired end.

CHAPTER IV

UNOFFICIAL ORGANIZATIONS

To complete our survey of the public scheme we may now pass in brief review the highly important work carried on by the numerous unofficial organizations which in various ways are working for the promotion of public health. This work is far-reaching in its influence, meeting a multitude of needs which, owing to the limitations in principle or the deficiencies in practice of governmental organization, are not met by the public authorities.

Such organizations are not simply philanthropic. Besides performing functions inappropriate to public authorities, it is their indispensable part to take up activities which are as yet only in the experimental or preëxperimental stage and to venture to test them out, thus exercising an initiative which might be deemed unjustified in an administrative organization spending public money. Eventually, if the enterprise succeeds and a new field for public activity is pointed out, then it may be transferred to the health authorities as a recognized department of administration. Thus possibilities are transformed first into actualities and then into permanent public functions. This has been the history of the anti-tuberculosis movement, for which the relative amount of public money spent is increasing from year to year; and it is now the history, in the working out, of child hygiene work.

Even where the governmental functions are firmly established, voluntary organizations play a useful part through coöperation. Recommendations and criticisms from such sources are frequently of value. The health

officer furthermore depends upon local organizations of this kind to a greater or less extent for the spreading of information and the fostering of the public support which he needs. Civic and philanthropic societies thus act as mediators between health officer and public.

In scope, such organizations range from the local to the national and international; in object, they are as diverse as the multitude of subjects related, directly or indirectly, to the public health. Only a summary of those of chief interest to the local health officer can be given here.

NATIONAL

The following are related directly to public health on a national scale:

The American Public Health Association is the oldest and the leading organization of the country devoted to the advancement of public hygiene. It was founded in 1872 and draws its members from the United States, Canada, Mexico, and Cuba. Its aims are: "the development and advancement of public hygiene; the correlation of principles and practice; and the promotion of public hygiene as a distinct profession." The Association holds an annual meeting (varying the place of meeting from year to year) which is the mecca of American public health officials and experts. . . . It is organized and meets for the reading of papers and discussion both as a general association and also in the following sections: laboratory, vital statistics, public health officials, sanitary engineering, and sociology. Important work, especially in the collection of data and the formulation of standards, is performed by the committees of the association. All persons engaged in official or technical work in public health lines or interested in public health work are eligible for membership.

The official organ of the association is the *American Journal of Public Health*, published monthly. The *Journal* is a running library on public health work and sanitary

engineering, and its volumes for completed years are indispensable works of reference to the health officer. The departments embraced are as follows: editorial; health department reports and notes; public health notes; recent articles on sanitary science and public health; papers of American Public Health Association; industrial hygiene and sanitation; personal notes; book reviews; and an index of current public health literature. Membership in the Association and subscription to the *Journal* are indispensable to health officers and other public health workers. Further information concerning both may be obtained from the Secretary, 755 Boylston Street, Boston. Subscription, $3 a year (3 months' trial, 50 cents).

The National Association for the Study and Prevention of Tuberculosis, 105 East 22nd Street, New York City, acts as a central bureau of exchange for information regarding tuberculosis, conducts investigations, manages the sale of Red Cross Seals for the tuberculosis campaign, publishes books and pamphlets, encourages local work, and has an annual meeting the proceedings of which are published. In particular, it issues a monthly bulletin for those interested in tuberculosis work and publishes the *Journal of the Outdoor Life*, a monthly periodical devoted to the prevention and cure of tuberculosis.

The American Association for Study and Prevention of Infant Mortality, 1211 Cathedral Street, Baltimore, gathers data, issues printed matter, has a traveling exhibit, and meets annually, publishing its proceedings in an annual volume of papers and discussions.

The National Housing Association, 105 East 22nd Street, New York City, conducts investigations, publishes books and pamphlets, and stimulates the formation of state and local societies for improving housing conditions.

The American Medical Association has a section devoted to Preventive Medicine and Public Health and a Council on Health and Public Instruction. In its *Journal* public

health matters are frequently discussed. In 1913 the Council called a conference of representatives of the fifty-odd national organizations related to public health for the purpose of forming a central organization to correlate their work. Office of the Association and *Journal:* 535 North Dearborn Street, Chicago.

The Committee of One Hundred on National Health has already been mentioned in Chapter III.

The following is a brief directory of some of the other organizations which enter directly or indirectly into the field of public health. These organizations collect data and issue reports and other literature and invite opportunities to coöperate and confer with officials and others desiring information or aid.

National Child Welfare Exhibition Committee (advises on exhibits and lends material for same), 200 Fifth Ave., New York City.

American School Hygiene Association; Secretary, Dr. T. A. Storey, College of the City of New York, New York City.

American Civic Association (fly, mosquito and smoke nuisances, etc.), Union Trust Building, Washington, D. C.

National Municipal League (civic organization, etc.), North American Building, Philadelphia.

American Association for Labor Legislation (publishes a volume on industrial diseases), 131 East 23rd Street, New York City.

American Social Hygiene Association (sex hygiene), 105 West 40th Street, New York City.

Society of Sanitary and Moral Prophylaxis (sex hygiene), 105 West 40th Street, New York City.

American Society for the Control of Cancer (disseminates knowledge concerning symptoms, diagnosis, treatment and prevention), 289 Fourth Avenue, New York City.

National Organization for Public Health Nursing (ob-

ject: " to stimulate the extension of public health nursing, to develop standards of technique, to maintain a central bureau of information "; publishes a quarterly and bulletins), 54 East 34th Street, New York City.

American Statistical Association (publishes a Quarterly), 491 Boylston Street, Boston.

Departments of Child-Helping and for Prevention of Blindness, Russell Sage Foundation, 130 East 22nd Street, New York City.

Department of Surveys and Exhibits, Russell Sage Foundation (makes health surveys and examinations of health department organizations and methods), 130 East 22nd Street, New York City.[1]

Bureau of Municipal Research (makes examinations of systems and efficiency of health and other municipal departments and maintains a Training School for Public Service), 261 Broadway, New York City.[1]

Besides the above there are a number of organizations dealing with special phases of sanitation, with civics, charities, medical research, and the like, which cannot be enumerated here. (For treatment of such subjects see the *Survey*, a weekly periodical devoted to social welfare, published at 105 East 22nd Street, New York City, which occasionally prints a directory of such organizations as mentioned above.)

[1] In considering the work of these organizations distinction should be made between a "survey of the public health situation" (which takes the figures readily available and forms judgments from these) and a thoroughgoing "public health survey" (which goes into local conditions in detail, making inspections, analyses, special statistical studies, etc.). Both forms of survey have a two-fold scope: on the one hand the sanitary conditions and problems, and on the other hand the organization and efficiency of the health department. Altogether the aim of a survey may be expressed as an evaluation of actual conditions with recommendations for necessary improvements. Both of the above organizations publish reports of the surveys which they have made in various towns and cities, which may be obtained on application.

Auxiliary Public Health Movements. — We must note a number of auxiliary movements which contribute directly to the general public health movement. There is, for example, the recent action of some life insurance companies in educating policy-holders in hygienic precautions, in providing visiting nurse service for policy-holders, and in endeavoring to obtain improvement of sanitary conditions and administration.

Then there is the movement of the employers, who are voluntarily paying increased attention to the hygiene of factories and labor.

There is, furthermore, a movement on the part of employees themselves. Trades organizations of all kinds are taking an interest in the hygienic problems of their particular trades. Such organizations play an important part in furthering compliance with health-protective measures in factories by imposing upon their members health rules (e.g., forbidding improper spitting) and by arranging for talks to their members on prevention of disease.

Again, there are trade organizations aiming at economical conformance with sanitary rules and at securing recognition of sanitary trade standards; of such the New York Sanitary Milk Dealers' Association is an example.

The certified milk movement, started a number of years ago (by physicians, however, and without any commercial object), with the object of obtaining and marketing under legal protection a high grade of milk is an excellent example of coöperation of physician, sanitarian and dealer.

The latest phase of the publicity movement is now to be seen in the establishment of more or less permanent exhibits or museums of hygiene. Thus the American Museum of Natural History, at New York, has developed a department of sanitary exhibits, together with a central exchange bureau for bacteria cultures. The New York City Department of Health maintains a permanent exhibit illustrating its work.

International Organizations. — Finally, capping the public health scheme, there are various international associations and congresses, dealing with tuberculosis and other branches of public hygiene and dominated by the *International Congresses on Hygiene and Demography.* The latter are held at intervals of from three to five years and always on the invitation of a national government, and give occasion for the greatest gatherings of hygienists in the world. The fifteenth Congress, for which over 3300 members were registered, was held in Washington in 1912. An extensive exhibition was held in connection with the Congress. Besides general lectures by men of eminence 510 papers were presented before the nine sections, treating of all branches of science and practice in personal and public hygiene. The papers and resultant discussions are published in a set of transactions which constitutes a veritable library on those subjects.[1]

STATE

Among non-governmental state organizations we may mention first the *health officers' associations* which are beginning to spring up in various states and which evidently fill so fundamental a need that doubtless there will soon be no state without one. Such associations, while perhaps nominally open to members of boards of health, are primarily for the executive officer. The objects aimed at are stated in the constitution of one of these associations as "the advancement of knowledge relating to public health and sanitation and the encouragement of social intercourse among health board officials." These objects are fulfilled by:

(1) Presentation of papers and discussion, which may be of a more local and informal character than in national

[1] *Trans. XV Internat. Congress Hyg. and Demogr.*, 8 vols., Government Printing Office, Washington, D. C., 1913.

organizations, and hence of a peculiar value to the members.

(2) Improvement and standardization of methods, procedures and forms (for records, reports, etc.), particularly as related to state laws and conditions.

(3) Formation and securing of needed state legislation.

(4) Raising the standards of administration through professional improvement of the members and maintenance of a reasonably high standard for membership.

(5) Promoting useful as well as agreeable social intercourse among health officials, both state and local.

(6) Coöperation with the state department of health, in every way promoting more effective relationship between state and local departments and officers.

Meetings of state associations may be successfully held four or five times a year, a program of a *few* important topics with one or two leading speakers being arranged for each meeting. One of these meetings may well consist in an annual conference of state and local health authorities held at the state capital, with a more extensive program and committee reports.

An active executive committee (which may act as a committee on program, resolutions and the like) is a prime necessity, as is also an enterprising membership committee with members working in all parts of the state. A few small committees on legislation, vital statistics, communicable disease, food and drugs, etc., are advisable. The plan of organization should be simple and the rules as few as possible. There should be a provision of state law that local boards of health defray the necessary expenses of their executive officers in attendance at meetings.[1]

[1] Further information regarding the organization of health officers' associations may be obtained through the state departments of health in those states where such associations have been formed: Massachusetts, New York, New Jersey, North Carolina, Connecticut, Michigan, etc.

In addition to the class of associations just discussed may be mentioned the state medical societies, sanitary associations, civic societies, anti-tuberculosis societies, and the like, which touch directly or indirectly public health matters, and in which, according to circumstances, the health officer may or may not take an active part.

LOCAL

Coöperation with local organizations bearing on public health or civics is one of the important phases of the work of the health officer. Such organizations are frequently of much value in that they perform, or at least assist in, work which the health department has not resources and authority to carry on alone. This applies especially to local societies engaged in tuberculosis and infant hygiene work of any kind. There may also be advantages in co-operating with the local bureau of organized charities and with the dispensaries and social service departments of hospitals. Where the inter-relations are extensive a scheme of "coöperation without amalgamation" should be definitely worked out, so that those social activities directly affecting public health may be properly correlated. By such a scheme, in detail, all the persons and organizations concerned may know exactly their relations to one another. It scarcely need be said that it is the health officer who should take the initiative and leadership in this broader phase of public health organization.

It is the part of wisdom to win the good will of civic clubs, women's clubs, local improvement societies, and the like. Such organizations, for example, frequently may arrange and advertise "clean-up" days or weeks which save the health department a great deal of routine inspection and notification and help to reduce the rubbish, fly and mosquito nuisances; may arrange for civic exhibits; and so forth. More important still, such organizations offer forums of discussion of civic health matters which

are of material assistance in the publicity campaign. The support of boards of trade and other business organizations whose membership includes influential citizens should be obtained, and the value of public health as a fundamental factor in prosperity should be impressed upon them.

In conclusion it may be said that the public health movement involves numerous inter-relationships, into which the health officer, without dissipating his energy, will enter just to the extent necessary most effectively to further his aims. This will vary according to circumstances.

CHAPTER V

THE NEW PUBLIC HEALTH

THE SCIENCE OF PUBLIC HEALTH

The importance of hygiene among the sciences and of sanitation among the practical arts is unquestioned. Health has ever been recognized as the chief basis for wealth and happiness and in this age is the subject of a science and administrative practice of its own. Hence we find the statesman Disraeli affirming that "the care of the public health is the first duty of the statesman."

Public health matters until recent decades lay largely in the realms of speculation and crude empirical knowledge. Such was the case until the development of physics and chemistry paved the way for the modern science of biology, of which hygiology, or sanitary science, is one grand division. Although it is the youngest of the physical sciences, biology has grown apace and the sum of hygienic knowledge has so developed that if it were now thoroughly applied to the conditions of human life there would result a wonderful amelioration. Application of the knowledge we already possess is perhaps a greater need of the time than the further extension of that knowledge.

This is not the place for an exhaustive treatment of the principles of sanitary science, which, as the foundation of all sound sanitary practice, are in this volume for the most part taken for granted. They will be found treated at length in various other works. A brief review of fundamental considerations must serve as introduction.

The student of hygiene is concerned with those conditions which prevent the body — that wonderful "physical mechanism" (as it is called by Huxley) — from running a normal course in health from birth to old age. Strictly speaking "senility," or old age, is the only natural death, but a glance at the mortality tables, as we shall see presently, shows that it is the given cause in very few cases, and that in the great majority of cases death is really premature.

The conditions which cut down many lives in length, or efficiency, or both, and cause premature old age, debility or death, are of three classes: (1) defects and weaknesses in the physical mechanism, i.e., constitutional handicaps; (2) abuses in the care of it by the owner — matters of personal hygiene; and (3) unfavorable environmental conditions. It is with the last-named — the control of the environmental factors through public hygiene — that health authorities are concerned.

Definitions. — We may now set down several convenient definitions. *General hygiene*, or simply "hygiene," is "the whole science and art of the conservation and promotion of health both in individuals and in communities" (Sedgwick). General hygiene is subdivided into:

Public hygiene, the care of the health of communities by public authorities; and

Personal hygiene, the care of the health of individuals by themselves.

Practically the two classes of hygiene merge into each other.

Sanitary science, or *public health science*, is the body of scientific principles governing public hygiene. (The term "preventive medicine" is also — less accurately — used in the same sense.) Those principles are practically applied through *sanitation*, which includes all the *sanitary arts*, such as sanitary engineering, the various branches of municipal sanitation and administration, and the like.

It is with the art of practical sanitary administration that the present volume is concerned.

The loose use of the word "sanitary" to denote merely cleanliness, absence of offence, and the like — as in "sanitary plumbing," "sanitary garbage cans," etc. — should be avoided.

THE PROBLEMS OF PUBLIC HEALTH

Statistical Survey of the Problem of Prevention. — Vital statistics (which will be discussed in the chapter on that subject) furnish the means by which problems of mortality and the prevention of sickness and death may be accurately gauged. For figures of a general nature we turn to the Mortality Statistics of the United States Census Bureau, from which the citations in this section are made.

The most general index of mortality in any population is the *annual death rate.* That rate for the *Registration Area* of the United States in 1913 was 14.1 per thousand of population. The figure is on the decline, being for previous years as follows: 1890, 19.6; 1900, 17.6; 1905, 16.0; 1910, 15.0; 1911, 14.2; 1912, 13.9. The rate 14.1 (or the corresponding figure for later years) is a convenient one to remember, representing, as it does, the average death-rate of a group constituting three-fifths of the population of the United States at the present time; it is the most nearly representative National death rate that we have. It strikes an average among all kinds of communities and between extremes of healthfulness and unhealthfulness. In the rural [1] part of the Registration States the rate in 1913 was 12.7, but in the cities of those States, where urban congestion and unsanitary factors make themselves greatly felt, it was 15.0. The rates for the largest Registration Cities ranged for 1913 from 8.4 to 20.8, many of the variances being explicable by differences in popula-

[1] From 1900 to 1909 the Census classified as rural places with a population of less than 8,000 and since 1910 those under 10,000.

tion characteristics as well as in sanitation (a consideration which will be explained later on in the chapter on Vital Statistics). For the individual Registration States that year the rates ranged from 8.5 to 17.1.

But such general rates tell us nothing as to premature and preventable mortality. To gain such knowledge the general, or total, mortality must be analyzed into its chief components.

The extent of premature mortality may be roughly gauged, for example, by a study of the *ages* at time of death. The fact that the average age at death in the Registration Area in 1913 was 39.8 years indicates, though crudely, that many individuals fail to reach the traditional age of "three-score years and ten." Further study shows that the death toll on infants is especially heavy. This constitutes the important problem of *infant mortality*. Thus in the Registration Area in 1913, 25 per cent of all deaths occurred under five years and 18 per cent under one year of age. (Table I and Chart 1 indicate the incidence of mortality on the population groups of various ages; showing the high infant death rate, the minimum rate at the age of 10 to 15 years, and, finally, the increasing mortality in later life reaching a maximum again at the most advanced ages.)

Now that it is evident that the great majority of deaths occur at ages which must be considered premature, the all-important question for the sanitarian is: *How many, and which of these deaths are practically preventable through public hygiene?* This leads to a consideration of *causes* of death.

TABLE I

Mortality According to Age

Population, deaths, and specific death rates, by age periods, for the U. S. Registration States,[1] 1911. (Figures furnished by courtesy of the Bureau of the Census.)

Age group	Population	Deaths[2]	
		Number	Rate per 1000 population of corresponding age
All ages	54,010,920	749,918	13.9
Under 1 year	1,183,384	133,636	112.9
1 to 5 years	4,468,804	52,553	11.8
Under 5 years	5,652,188	186,189	32.9
5 to 10 years	5,166,113	15,973	3.1
10 to 15 years	4,935,045	10,898	2.2
15 to 20 years	5,098,472	18,370	3.6
20 to 25 years	5,296,929	27,586	5.2
25 to 35 years	9,270,326	59,079	6.4
35 to 45 years	7,409,542	65,896	8.9
45 to 55 years	5,363,885	73,040	13.6
55 to 65 years	3,220,105	84,226	26.2
65 to 75 years	1,832,530	101,101	55.2
75 and over	765,785	106,352	138.9
Unknown age[3]	....	1,208	....

[1] Includes District of Columbia, but excludes North Carolina.

[2] Exclusive of stillbirths.

[3] Unknown age not distributed.

In the first place, in Chart 1 the chief preventable causes of death at the various ages are roughly indicated by the lettered brackets, as follows:

A. Infant mortality (various causes).

B. Communicable diseases of childhood.

C. Tuberculosis and typhoid fever.

In addition, there are also given, though not directly subject to public health administration:

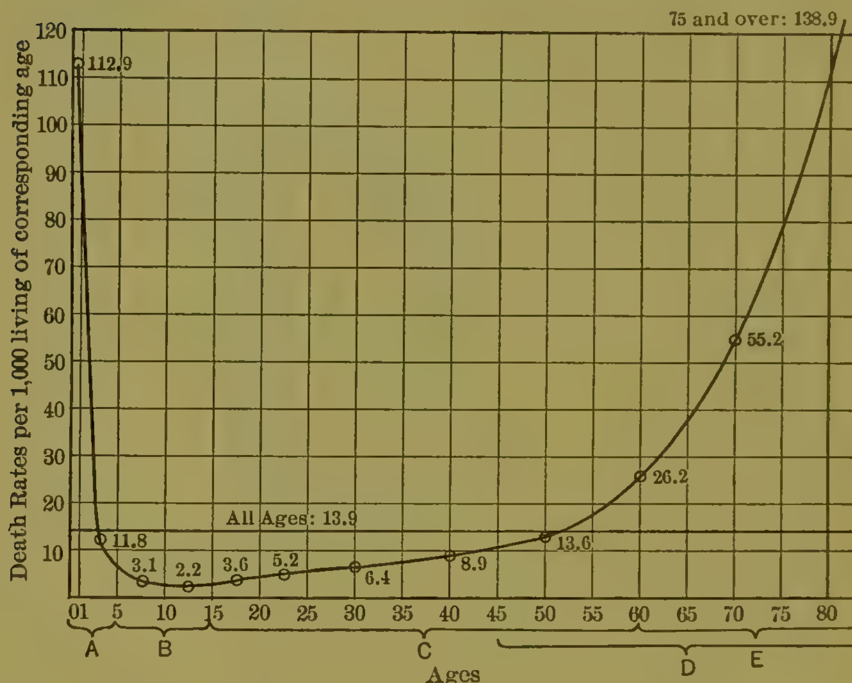
D. Premature degeneration of circulatory, urinary, and other systems, and various constitutional causes; and

E. Advancing debility of old age.

Under the last two heads it must be remembered, however, that death is actually due to (and should be set down to) specific causes favored or brought on by the degeneration,

CHART 1. DEATH RATES BY AGES

U. S. Registration States, 1911. (Based on Table I.) For explanation of "A," "B," etc., see text



constitutional defect, or debility. The practice of vital statistics prescribes that the specific cause rather than the general condition be used in describing deaths. Also, the distribution is by no means as exact as indicated in the chart, which is in this respect only roughly illustrative, and no note is made of the environmental conditions which affect all ages.

In further analysis there are shown in Table II and Chart 2 the death rates in the Registration Area, for 1906–1910, for certain *specific causes* of death.

TABLE II

Death Rates by Cause

Registration Area of the United States: Annual Averages, 1906–1910 inclusive. (From U. S. Mortality Statistics for 1911, Bureau of the Census.) Stillbirths not included. For explanation of the table, see the text.

Specially noteworthy preventable causes (see p. 77) in heavy-faced type.

Titles in brackets [ ] are disapproved by the Census Bureau as indefinite or otherwise undesirable, though necessarily retained for the present.

Nos.[1]	Cause		Death rate per 100,000 of population
	All causes		1511.5
28–35	**Tuberculosis** (total)		169
	Of the lungs	146.8	
	Tuberculous meningitis	9.1	
	Abdominal tuberculosis	6.0	
	Pott's disease (tub. of spine)	1.5	
	[White swellings] (tub. of joints)	0.7	
	Other organs[2]	2.1	
	Disseminated tuberculosis	2.5	
79	Organic diseases of the heart		133
92	**Pneumonia** (total)		103
91	**Bronchopneumonia**		40
104	**Diarrhœa and Enteritis (under 2 years)**		96
120	Bright's disease		87
39–45	Cancer (and other malignant tumors) (total)		73
64	Cerebral hemorrhage, apoplexy		72
151	[Congenital debility], icterus, and sclerema (including premature birth but not stillbirth)		64.5
150	Congenital malformations (stillbirths not included)		14.9
154	[Senility (old age)]		29

[1] According to Detailed International List.

[2] For recent years acute miliary tuberculosis is given separately by the Census; figures not available for 1906–10.

Nos.[1]	Cause	Death rate per 100,000 of population
1	**Typhoid fever**	25.6
9	**Diphtheria** [and croup]	22.4
10	Influenza	16.4
8	**Whooping cough**	11.5
6	**Measles**	10.8
7	**Scarlet fever**	10.6
14	**Dysentery (amebic, bacillary)**	6.5
37	**Syphilis**	5.4
18	Erysipelas	4.2
20	Purulent infection and septicemia	3.8
24	**Tetanus**	2.7
4	**Malaria**	2.6
63 (in part)	**Acute anterior poliomyelitis [infantile paralysis]**[3]	1.8[4]
13	[Cholera nostras]	1.0
61 (in part)	**Cerebrospinal fever** (epidemic cerebrospinal meningitis)	0.9[4]
38	**Gonococcus infection**	0.3
5	**Smallpox**	0.[illegible]
19	Other epidemic diseases	0.3[5]
23	**Rabies**	0.2
26	Pellagra[3]	0.2
57	**Chronic lead poisoning**	0.2
58	**Other chronic occupational poisonings**	....[5]
59	Other chronic poisonings	0.5
25	Mycoses	0.1

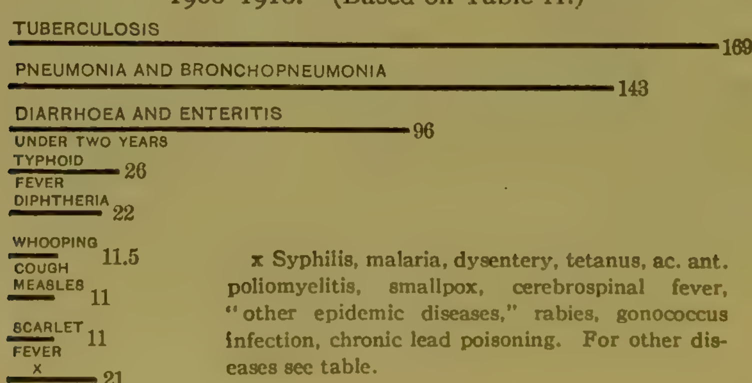
[3] Transmission of ac. ant. poliomyelitis not well understood, that of pellagra undetermined.

[4] 1911 only.

[5] The following communicable causes not included under "other epidemic diseases" had a rate of less than one-tenth of 1 per 100,000: — typhus fever, relapsing fever, miliary fever, plague, yellow fever, leprosy, glanders, anthrax, "other chronic occupational poisonings." There were no deaths from Asiatic cholera.

CHART 2. DEATH RATES FOR CHIEF PREVENTABLE DISEASES

U. S. Registration Area, average annual rates per 100,000 population, 1906–1910. (Based on Table II.)



x Syphilis, malaria, dysentery, tetanus, ac. ant. poliomyelitis, smallpox, cerebrospinal fever, "other epidemic diseases," rabies, gonococcus infection, chronic lead poisoning. For other diseases see table.

This table includes those causes of death having a rate of over 50 (omitting the group of "accidental or undefined" causes), senility, and all the communicable diseases. In the chart only the figures for the chief preventable diseases are given.[1]

The term "*preventable*" is used here and in general throughout this volume to denote that the disease is wholly or in considerable part preventable through practicable public health measures, thus leaving out of present consideration heredity, personal hygiene and prophylaxis, and other factors not dealt with directly by the public health official. Even so, the designation requires qualification in some instances. Thus, under pneumonia, those deaths which occur in infancy (about one-third) are largely preventable through infant hygiene work, while the remainder are only indirectly and difficultly preventable, so far as public health practice has thus far shown (see, however, discussion under Pneumonia, Part II, Chapter I). Even among those causes which may more freely be termed preventable there are vast differences in the degree of preventability. Malaria

[1] The last bar on the chart represents collectively the smaller figures, some of which require comment. Thus, the figure for rabies is probably somewhat in deficiency of the truth on account of non-recognition of some of the deaths from this cause, and at any rate does not adequately indicate the importance of this absolutely preventable disease. Nor is the potential danger of smallpox shown in its present low death-rate. Regarding syphilis and gonococcus infection, the figures are again deficient. Most of the effects of venereal disease appear under forms the venereal origin of which is not often mentioned in the death certificate. The venereal diseases constitute a problem of preventive medicine of great magnitude and of extreme practical difficulty, in spite of which, however, some of the most advanced health authorities are taking administrative measures against them. The term "dysentery" is unsatisfactory, doubtless including a certain number of deaths which should properly be put down to "diarrhœa and enteritis." (For discussion of the errors to which the various terms are subject, see Part II, Chap. IX.) In general, it must be added, the importance of a cause depends not only upon the amount of mortality produced by it but also upon the degree to which that mortality may be prevented.

and smallpox could readily be wiped out by the thorough application of practical measures now known, and the same may be said of typhoid, with the exception of a stubborn "residual," but scarlet fever and diphtheria present deeper and less soluble problems. In tuberculosis and in infant mortality (due to pneumonia, diarrhœa and enteritis, and other causes) the reduction process, though clearly indicated, is especially complicated by considerations of personal hygiene and will, it appears, even under the best conditions be long and gradual. In measles and whooping-cough, the extent of practical prevention has thus far proved slight.

The effects of the communicable diseases on mortality are probably greater than is supposed even by students of mortality returns. The damage to vitality even in the non-fatal cases is doubtless a potent predisposing influence which aids in swelling the list of deaths from other causes. Such deaths, while frequently not ascribed in any degree to any of the communicable diseases, nevertheless may be due in part — in many cases in great part — to the effects of previous disease of the communicable class. It has, for instance, lately been shown by Woodruff[1] that typhoid predisposes to tuberculosis; and if to tuberculosis why not to diseases of the constitutional class? (Tuberculosis itself may, indeed, be considered as virtually a constitutional disease, being so widespread as to attack almost anyone whose vital resistance falls below the safe limit.) Even with the "minor" contagious diseases, there is evidence that these tend to permanently injure the heart, kidneys, and other vital organs, so that their effects may be felt years afterwards, in middle life.

The health official has to consider, not only actual, demonstrable, *direct* mortality from the communicable diseases, but also their *indirect* contributions to the mortality from

[1] Woodruff, "Tuberculosis Following Typhoid Fever," *Am. Medicine*, 1914, N. S., vol. XI, no. 1, p. 17.

other diseases, and, furthermore, the immense and incalculable amount of pain, inconvenience and expense caused by the *sickness* from communicable causes.

Prevention is Relative. — "Prevention" under present conditions, is a relative, not an absolute term. Many diseases may be reduced, but few absolutely prevented. While the term "preventable" tends to a justifiable optimism, it might, nevertheless, be preferable that in scientific language we speak rather of "reducible" diseases.

It is on account of their preventability, or reducibility, that such diseases, no matter what their rates, are included in the table and chart. For, no matter what the general death rate and specific death-rates may be, the work of the sanitarian and health officer regards specifically the possibilities of prevention.

Diseases not Subject to Public Health Measures. — The remaining causes of death in Table II are of the class of constitutional or environmental causes which are practically uncontrollable or subject to control only or chiefly through personal hygiene.

Organic diseases of the heart, Bright's disease, and cerebral hæmorrhage and apoplexy are largely manifestations of those degenerations or defects of the circulatory and urinary systems which can be retarded or compensated for only by the hygiene of private life, — though even here, as we have already shown, there is an indirect effect of certain communicable diseases of childhood and adult life.

Congenital malformation and debility are great causes of infant deaths toward the prevention of which little has been accomplished; the reduction of venereal disease, with other measures, however, promises some progress in this direction.

Cancer is a disease which is apparently on the increase, possibly because of the greater number of persons surviving to reach the cancer age of late middle life; the researches now being carried on give hope that the cause and means

of prevention and cure may be ascertained in the near future.

Influenza is a communicable disease the spread of which may be reduced through home isolation and personal prophylaxis, but which is impracticable of attack by public health authorities; thus, it is in the same class as pneumonia, measles and whooping-cough, although with these last two, on account of their prevalence among school-children, reports from physicians are required and some attempt made at quarantine.

The comparatively low position in the list of "senility," or old age, the only strictly natural cause of death, is interesting to note and it would probably stand considerably lower if, in all cases, the disease actually causing death were stated rather than the general term "old age." At any rate the term is, from a statistical standpoint, unsatisfactory. It would appear from statistical study that while old age is a contributory, or predisposing, cause of death in many cases and the main cause in many others, it is the sole cause in very, very few. Thus, it should be regarded, not as a specific cause of death, but rather as a condition potently favoring mortality.

Fundamental Needs. — Reasonable purity of air, water, and food and freedom from communicable disease have from ancient times been the great sanitary desiderata of the human race. They are evidently the fundamental requirements in any stage of society. The complex sanitary needs of today spring from these great roots, affecting not merely individuals or small groups, but very frequently the whole community, for which reason they are the subjects of public rather than of personal hygiene. While the individuals of the family may regulate their manner of eating, sleeping, and the like, with comparatively little reference to the conduct of others, they cannot so regulate the quality of the air, water, and food which they consume, nor can they assure themselves of freedom from

the communicable diseases of their neighbors. The air which the citizen breathes may be that of the common atmosphere of the factory, the water and the food which he consumes may be drawn from common public supplies far beyond his inspection or even knowledge.

The more complex the civilization the greater are the sanitary needs. Such needs depend chiefly upon two things: congestion, favoring much association between persons and families in close proximity to one another; and intercommunication, enabling ready and rapid interchange of persons and commodities between communities at a distance from one another. Consider, for example, a rural district where the families have separate and independent water-supplies, raise their own foods, live on isolated farms, and have little communication, either by person or otherwise with one another or with persons outside of their limited environment. Under such conditions there are practically no problems of public hygiene. The hygienic problems are of a personal character, or at least limited to the family. But once such a community begins to concentrate itself in even the smallest hamlets, sanitary problems of a public nature begin to appear; and when intercommunication with the outer world begins, then the sanitary problems (as we have seen in a previous chapter) take on a state-wide character.

While sanitary needs remain always fundamentally the same, the forms in which they appear are ever changing and ever new. In the progress of civilization from the simple to the complex, man produces for himself not only new conveniences and comforts but also, simultaneously, new inconveniences and discomforts. In making life in some respects more secure, he makes it in other respects more dangerous. A whole step forward may involve a half-step back. New problems grow, Hydra-like, even in the moment the old are cut away. In the bargain which man drives with his natural enemies he must take certain

new disadvantages as part of the exchange. Sanitation can never be a finished art.

Anomalous Position of Modern Sanitary Authorities. — Sanitary authorities today, in their powers and methods, are subject to influences from two different quarters: (1) *tradition*, and (2) *modern sanitary science*. There are certain assumed duties which we may call the old public health, venerated by many officials as the foundation of their office and demanded, frequently, by public opinion. Side by side with these and at some variance with them are the activities which modern discoveries indicate as the main line of advance — the new public health. The present in the public health field is, therefore, a stage of transition, of re-adjustment, of expansion. Hence, the inconsistencies in public health work, the great differences in balance and emphasis between one board of health and another, and the absence of a consensus of opinion as to what constitutes a rational program. One board lays the emphasis on plumbing and nuisance inspections while comparatively neglecting food supplies; another expends its chief energy on milk supervision, or stringent quarantine, or some other particular point. Measures zealously practised in one quarter are held in slight esteem in others. It is the object of this volume to examine into such discrepancies and, so far as possible, to strike a correct balance among them. It is the problem of the health officer to weigh and sift, to save what is valuable in tradition and experience while casting out the valueless residue, and at the same time to utilize those of the new principles which have been proved beyond doubt.

THE OLD PUBLIC HEALTH

We need not go deeply into traditional public health principles. They are familiar to all who are concerned with routine health department work and even to the general public. Epidemic disease was suppressed after it

had appeared, rather than prevented in the true sense. The function of nuisance abatement loomed large, for the pythogenic, or filth origin, theory of disease taught what we now know to be untrue, that disease may originate in all kinds of filth. In other directions, such as in the supervision of food supplies, little was attempted.

Surviving Fallacies. — The chief consideration in connection with the old public health is that we must recognize the survival of the old theories in the popular mind and even in the minds of health officers themselves. Tradition gives way but slowly, and the continued adverse influence of the errors of the past is still strongly felt today. Hence the need for the re-education both of health officers and public. The surviving fallacies are all the more difficult to dislodge in that in many cases they contain the element of a half-truth.

1. *Sanitary Significance of Dirt*

The question of the sanitary significance of dirt has probably been the occasion of more loose thinking than any other topic in hygiene. Instinct, of course, teaches an abhorrence of decaying organic matter, and history gives evidence of the care exercised in the disposal of putrescible matter. Then, in the middle of the nineteenth century, was announced Murchison's "pythogenic" theory of disease, which held filth to be dangerous, not merely as a predisposing condition or as the possible vehicle of disease, but as the very source of disease. The *materies morbi*, or causative agent of disease, was thought to arise *de novo* out of filth. Today we know that this theory is false, but even today it still continues to exercise an influence. Many persons still unfortunately believe that diphtheria or typhoid fever or some other disease may arise from decaying garbage or may be caused by the much-dreaded sewer gas.

Let us separate the truth from the error in the vague,

general condemnation of filth, and discriminate between what is actually dangerous and what is merely unpleasant or mildly detrimental. Science now shows that there are various kinds of filth, some of which are deadly — such as the undisinfected excreta of typhoid fever and other intestinal diseases — and some of which are practically harmless, a fact recognized in the popular phrase "good honest dirt," and between the two extremes there are various degrees.

Certain things are specifically dangerous: above all the disease-spreading privy vault; then, in a lesser degree, the neglected manure-pile breeding the disease-bearing fly, stagnant water breeding malarial or yellow-fever mosquitoes, the unkempt dwelling harboring rats and other vermin, potential carriers of specific disease. Then again, more important, certain habits are dangerous, and personal uncleanliness in a broad sense stands convicted by scientific evidence as being the greatest single factor in the spread of many of the common communicable diseases.

We may go even further and say that dirt is at least suspicious if not dangerous, and largely for the reason that the dangerous kinds of dirtiness and the innocuous kinds are likely to be all mixed up together. Dirty surroundings and dirty habits usually go together. A city with dirty streets is presumably one controlled by slovenly or indifferent people, and those are the class which sanitarians have learned to fear. Again, it is doubtless true that dirt in itself exerts a depressing influence on the human organism, particularly that of the infant.

Such facts clearly show that filth is, generally speaking, inimical to health and a subject for health administration. The present difficulty, however, is that there is in practice little or no discrimination among the different kinds of filth. In other words, the health officer — whose resources are limited — must recognize what forms of uncleanliness are most objectionable and attack those *first*. Thus, he

will find that while a campaign for street-cleaning will produce little in the way of vital results, a campaign for sewers and the abolition of privy-vaults will result in great and immediate benefit to public health. Never should he be led to expend valuable energy, needed for more important matters, in pursuing merely superficial conditions, such as dirty alleys, faulty garbage collection, and the like. These may be real complaints and should be dealt with as effectively as may be, but they are, it must always be remembered, distinctly subordinate in the public health campaign. Let him rather wage war on the known modes of the spread of disease: dirty hands and food supplies, the unclean typhoid carrier, the insanitary privy-vault, and the like.

The most damaging effect of false ideas as to dirt is that attention is distracted from more important things. Thus, we now know that the most dangerous kind of uncleanliness is personal uncleanliness, and persons who forget this and clamor instead about inadequacies in garbage collection and plumbing inspection are ignoring, and leading others to neglect, the real paths of infection.

2. *Sewer Gas and Foul Odors*

A special misconception of the class just referred to relates to the supposed dangers from sewer gas and foul odors. The emanations from sewage and other decomposing organic matter have, erroneously, been held directly responsible for typhoid fever, diphtheria, malaria, and what-not; and the sewer-gas bugaboo is still apparently entertained by most people today. The strictness of plumbing regulations is a testimony to the importance ascribed to the exclusion of even minute quantities of sewer gas from dwellings.

The theory of sewer gas as a source of disease has been exploded by researches which prove that it is practically free from elements especially detrimental to health and

that the danger of air infection, even from foaming and splashing sewage, is practically negligible.[1] Nevertheless, the popular notion of the dangers from sewer gas still vigorously persists, being, as Rosenau says, " the residual legatee of Murchison's pythogenic theory."

Of course, sewer gas is detrimental to comfort and may exert a depressing influence on the human organism. Foul odors presumed to arise from defective plumbing and the like should not be permitted to pass without inspection. They may indicate conditions dangerous to health, such, for example, as improper disposal of excreta, or broken drains giving rise to infection through flies, vermin, or food or water supplies. Also, the odors in question may really be due to escapage of illuminating gas, which, even in small quantities in the air of a dwelling-house, may be highly detrimental to health.

But we no longer trace any special connection between sewer gas and disease, and it is to be hoped that popular alarms on the subject will soon cease.

3. *Stagnant Water and Miasms*

A connection between stagnant water and fevers is traditional. Related to it is mistrust of the upturned soil and of the night air in marshy regions. In general, residence in low, damp, or marshy regions or in the neighborhood of swamps has been thought unhealthful because of the supposed poisonous "miasms" arising therefrom. And, certainly, fevers have frequently attacked persons under such conditions.

Sanitary science now explains the underlying phenomena of such experience. The fevers in question are usually either malarial or typhoid fever. The first is transmitted through the bite of the anopheles mosquito (and only thus), and such mosquitoes breed in stagnant water. The

[1] See Rosenau, "Preventive Medicine and Hygiene," 1913, pp. 638–640.

same may be said of yellow fever, transmitted by another species of mosquito in the swampy regions of the south and the tropics. The upturning of soil incident to certain kinds of construction work means hollows for the accumulation and stagnation of water, while the presence among laborers (e.g., those from malarial districts of Italy and elsewhere) of malarial individuals who act as a source of infection of the mosquitoes is not unlikely. The suspicion of night air is explained by the fact that the anopheles (malarial) mosquito flies only by night. Witness the classic experiments of Sambon, Low and Terzi, who avoided contracting malaria in the malarial Roman Campagna by the simple precaution of keeping within their well-screened hut from before sunset until after sunrise. Thus science explains a popular suspicion by showing exactly what the danger to health is.

In a somewhat similar manner an indirect connection may be traced between the upturning of soil and the occurrence of typhoid fever. Consider that excavation work means the presence of laborers, some of whom may be mildly infected typhoid "carriers." Consider further that the sanitary arrangements may be very imperfect, and the infection of the neighborhood through flies, water, etc., may thus readily take place. The lesson, of course, is not the avoidance of excavations, as once was thought, but proper sanitation in connection with them.

4. *Imaginary Purification of Running Water*

As for water-supplies, stagnant water is on the whole less likely to convey infection than flowing. The saying "running water purifies itself" has been a disastrous one in the history of sanitation. Some popular tradition even asserts that water is purified after running seven miles. We now know that while indeed, through the aeration of splashing, chemical purification may be favored in a running stream, and the water made agreeable to sight

and smell, the same rule does not apply to bacterial purification. A sparkling water may still contain the germs of typhoid fever or other intestinal disease; mere appearances are no criterion. The modern science of water bacteriology shows that purification from pathogenic germs is favored in *standing* rather than in running water. The principal purifying factors are sedimentation (or settling out of suspended matters) and *time*. Hence the value of storage of water supplies. In rapidly running waters these factors have no place, hence the greater danger of conveyance of infection. (See Part II, Chapter IV.)

Further examples of the popular misconceptions so frequently met with, which the health officer has to combat, might be given, but enough has been said to clear the ground for a consideration of the duties of sanitary authorities as pointed out by modern sanitary science.

THE NEW PUBLIC HEALTH

The sanitary science of today is characterized by definite qualitative and quantitative knowledge. Of this fact the great example is to be seen in the germ theory of disease and its far-reaching developments in sanitary and pathological bacteriology. Instead of " miasms," " influences," " poisons," *materies morbi*, and other vaguely surmised causes of disease, there is now definite knowledge of specific causative organisms: the bacilli of tuberculosis, diphtheria, typhoid fever, and the rest. The list of communicable diseases subject to control has been much lengthened. Distinctions have been worked out; we know that some diseases may creep like fire in the underbrush, while others spread like wildfire.

Tuberculosis, once supposed hereditary and non-preventable, is now transferred to the list of preventables. To that list the whole class of insect-borne diseases is added. Nuisances are scrutinized to ascertain whether they really favor or indicate the transmission of disease

or whether they are merely objectionable on grounds of æsthetics, decency, or comfort. In the hygiene of air-supplies, instead of the theorizings which have left ventilation one of the least developed of the sanitary arts, there is definite and increasing knowledge as to the physiological effects of heat, humidity, dust and gases, and ventilating engineering is now a distinct and progressing art. In regard to water-supplies, bacteriology shows that the presence of the specific germs of typhoid fever and other water-borne diseases must be guarded against and that mere absence of offensive odor and taste does not assure this; while bacteriology and chemistry join in furnishing the means of detecting the presence of the germs and of the sewage matters associated with them. As to food-supplies, the dangers of transmission of germ disease by articles of food (especially milk) are clearly recognized, while on the other hand deleterious contamination, fermentations, and decompositions are much better understood than formerly. In short, there has been built an imposing and still growing structure of sanitary science, of which epidemiology, sanitary bacteriology, sanitary chemistry, and the allied sciences are the component parts.

In the new methods, both technical and administrative, the *quantitative* element is prominent. The question, "Is this or that detrimental to the public health?" is followed by the inquiry, "How detrimental?" Many things affect the public health and practical considerations forbid equal attention to all of them. In any particular instance the problem is whether administrative measures are advisable, and, if so, what they shall be and how far they shall go. Does terminal disinfection always pay? Which, judged from sanitary and economic standpoints, is the better course: pasteurization of milk or the elimination of tuberculous cows? Such quantitative questions as these are common. Expenditure of money must be adjusted to probable results, and sanitary research and

municipal budgets are coming into closer relation. The methods of the actuary are applied to public health work, and results, so far as they are economic, are estimated in terms of dollars and cents. The economic problems arising out of sanitary restrictions are receiving attention.

The new public health applies principles, rather than formulas or customs. Problems are decided, not by dictum or on *a priori* grounds, but by actual test, in the laboratory, in the field, or at the statistical desk. Health departments are being overhauled and time-honored routines put to the test.

Scope of the New Public Health

The field of the new public health may be summarized as follows:

I. *General Administration.*

II. *Registration (reports of communicable disease, vital statistics, etc.).*

III. *General Sanitation (housing, factory sanitation, nuisances, etc.).*

IV. *Prevention and Control of Communicable Disease.*

V. *Child Hygiene.*

VI. *Supervision of Food and Water Supplies.*

VII. *Other Functions (maintenance of hospitals, research, etc.).*

In comparison with the ideas of the old public health we see many changes and developments in the above.

General administration and registration work, for example, have become so important as to merit separate classification.

The old function of nuisance abatement is now reckoned as only a subdivision of the general sanitary control of the new environment, in which the housing and factory problems now loom large. The old function of suppressing epidemics after their appearance has been enlarged until it now means the constant control, by scientific prevention,

of communicable disease at all times. Sanitary authorities are even going further and in infant hygiene work are attacking disease which is preventable though not communicable by methods which press into the realm of personal hygiene.

The supervision of food supplies has been much extended, as may be seen from the present-day complex pure food laws. The regulation of milk-supplies has received an especially large share of attention. To this head has also been added the scientific control of water-supplies.

The list does not include public works of the nature of sanitary engineering — e.g., refuse collection and disposal, street-cleaning, sewerage (including plumbing inspection), and the like — for the reason that these should be assigned to the engineering departments of municipal administration. While these, like parks and water-supplies, indirectly affect public health, they are not primarily matters of health administration, and a natural division of activities requires that they be assigned to special city departments.

The vantage point in the shift from old to new is indicated by Dr. H. W. Hill[1] (whose phrasing suggested the title of the present chapter) in the statement that "the old public health was concerned with the environment; the new is concerned with the individual. The old sought the sources of infection in the surroundings of man; the new finds them in man himself." There is much truth in this. Human conduct is the great factor in public hygiene, and also the most difficult to control. Persons and their actions (especially their habits) are more important than things and their properties. Even the problem of environment is, of course, one of the modifications by man of the conditions surrounding his life, and not of mere passive protection against them.

[1] Hill, "The New Public Health," Press of the *Journal-Lancet*, Minneapolis, Minn., 1913 (50 cents); also book of same title (Macmillan, 1914).

Sanitary Education and Publicity. — A notable characteristic of the new scheme is the education of the people in some of the elements of personal and public hygiene. Sanitary education implies not only sound instruction of the growing generation, but also popular enlightenment through systematized publicity work. The latter will be taken up later in a separate chapter.

Some Uncontrollable Factors. — The program which has been sketched by no means covers the whole range of factors affecting the public health, but only those susceptible of public control. The uncontrollable, or only partly controllable, factors should not be lost sight of in any estimate of administration and its results.

The character of the population, for example, may present many such. Age and race distribution may favor or may work against measures of sanitary control. Thus, the large negro element in the South tends to produce an increased mortality which is combatted with difficulty by the sanitary authorities. Then there are climatic conditions: the long warm seasons of the South favor the life of pathogenic organisms in the environment and tend to increase the incidence of insect-borne diseases; while more severe and changeable climates favor affections of the respiratory system. Seasonal variations have their effects, as has been noted in the tendency of hot summers to increase infant mortality. Standards of living, which are notoriously subject to fluctuation, undoubtedly affect the public health.[1] Some of these influences affecting the general death-rate will be discussed more fully under Vital Statistics.

Proportion in Work of Sanitary Authorities. — The prime duty of sanitary authorities is to strive toward higher ideals of administration. In order to approach

[1] Although this subject is of considerable sanitary and sociological interest, it is little understood. There is reason to believe that the phenomena are not altogether what would be anticipated; for example,

those ideals it is necessary to do certain things very well indeed, which means that the field for action must be carefully defined in order that energy may not be spent in ways of little profit. The usual health appropriation allows no room for expenditures which do not directly and demonstrably affect the public health and the health officer is to be congratulated who, without waste of money or effort, recognizes and accomplishes the essential for his community.[1] The law of diminishing returns must be taken into account. Outside of the things that may easily be distinguished as obvious duties there is a choice which requires discretion. The health officer feels himself drawn to go into publicity work, to co-operate with philanthropies, perhaps to take counsel with civic reformers. These things may be good in a degree, but must be subordinated to a well-balanced administrative program.

Obstacles to Progress. — Ignorance of sanitary needs and indifference to them are the chief enemies of sanitary progress. One rôle of the health officer is to point out both needs and remedies and to break the vicious circle of low standards, insufficient funds, and poor sanitation which not infrequently prevails. The first step is the preparation of a statement of needs, based so far as possible on reliable vital statistics, with a detailed scheme of proposed work with its cost. Judicious publicity on the situation and tact in obtaining the coöperation of the

"hard times," instead of increasing death rates through privation, lowered nutrition, etc., appear, under some circumstances at least, to decrease them through enforced moderation in labor, food, and drink, enforced idling (in the open air), and reduction to simple, inexpensive, and healthful pleasures. Industrial depression also tends to decrease birth-rates, which would mean a lower infant mortality. Some remarks on the question are included in a paper by W. T. Sedgwick and the present writer: "On the Mills-Reincke Phenomenon, etc.," *Jour. Inf. Diseases*, 1910, vol. VII, no. 4, p. 489.

[1] See Chapin, "How Shall We Spend the Health Appropriation?" *Am. Jour. Pub. Health*, 1913, vol. III, no. 3, p. 202.

council or other governing body which fixes appropriations, are important considerations. When the results that will follow the accomplishment of a thorough public health program are pointed out, the cost should cease to be an objection.

Local pride must be tactfully dealt with. Almost every community is under the impression, fostered perhaps by the utterances of prominent but uninformed citizens, that it is one of the healthiest spots in the United States. This impression is strengthened in numerous ways and is usually left untouched, if it is not supported, by the public press. It is an impression which people unconsciously wish to have strengthened, just as the individual likes to minimize any ailment he may have and avoids consulting the doctor, who, he knows, may prescribe some radical change in regimen. The average community will put up with a great many surface indications of radically bad conditions before it will turn its attention to the conditions themselves and their remedies. For one reason, such indications are usually scattered. One citizen or group of citizens has but a very limited view, and so long as there is no general "survey," conditions in the mass are unknown to the citizens as a mass. If a citizen or society with the reform spirit rises and proclaims the salient results of investigation, he is likely to be treated at first to the same old indifference. If, however, he perseveres in urging a few striking points in such a way as to move his public without antagonizing it, he will eventually get a hearing. The problem then is to get a *thorough* survey and study of the facts, in which it may be necessary to obtain the services of a qualified sanitary expert — not a mere passing "investigation" which leaves fundamental conditions untouched; and, finally, to get permanent remedial action. In this last object the health officer may have to consider what motives are to be urged for more and better public health work.

The Motives for Public Health Work. — Indifference may go on until some appalling revelation or even a severe attack of epidemic disease compels attention. There are instances in which public health reform was precipitated by an epidemic. Thus the town of Montclair, New Jersey, experienced in 1894 a severe epidemic of milk-borne typhoid fever, as a consequence of which the town immediately instituted thorough health work under a full-time, trained health officer and has had a health department of a high order ever since. Before going through such an experience it is but prudence to take stock of the situation in time.

What motives may be appealed to for support of public health work? It has been proposed in some quarters to estimate the results of such work in dollars and cents and to use such an estimate as the basis of appeal. Given certain pecuniary values of lives, a rough estimate may be made of the economic saving in mortality and morbidity avoided. The money argument has been advanced by Irving Fisher and other economists and sociologists who aim to replace vague sentimental appeals by something more tangible. On this principle Whipple[1] has worked out in money terms the saving in sickness and deaths resultant from the substitution of pure for polluted public water-supplies.

This method of appeal, however, has not, it seems to the writer, a wide range of usefulness. The fact is that as Chapin[2] says, "there is much in the world which cannot be measured in terms of money, though to so measure it is doubtless the tendency of the age." The money valuation is highly inexact and does not cover the whole question of benefits from health work. The lives of laborers may have a low economic value, yet are as much entitled to

[1] Whipple, "The Value of Pure Water."

[2] Chapin, "The Value of Human Life," *Am. Jour. Public Health*, 1913, vol. 3, no. 2, p. 101.

the protection of the law as those of individuals of greater economic value. Of course, it is not to be denied that in dealing with finance committees certain money calculations of proposed benefits may have some value and may be used for what they are worth.

On the whole, it is best to base arguments for health work directly upon high ideals of administration and make quantitative statements in terms of lives saved (or to be saved) and sicknesses prevented, leaving to the imagination the immensurable total saving in suffering, sorrow, economic loss, and the rest, which is implied. Such is the true use of vital statistics. Costs may be expressed in dollars and cents, but the natural and direct expression of results is in the saving of vitality.

The Costs of Public Health Work. — Owing to local differences it is impossible to set any hard and fast figure as a standard for health expenditures. Various estimates for the minimum wage which would be required by most health departments have, however, been made, while figures as to actual expenditures have been collected by Schneider.[1] The Committee on Activities of Municipal Health Departments, of the American Public Health Association, set the minimum per capita appropriation required at 50 cents.[2] One authority (Park) asks for a minimum ranging from 50 cents to $1 per inhabitant, according to the size of the city. The investigation by Schneider (in 1913) showed that in 119 American cities, containing in 1910 a population of 17,525,000, the yearly expenditure for prevention of disease was but 38.4 cents a head, the

[1] Schneider, "Activities of Municipal Health Departments," Department of Surveys and Exhibits of the Russell Sage Foundation, 130 East 22nd St., New York City.

[2] Such figures should, and it is believed that those here quoted do, refer only to expenditures which are for prevention of disease through activities which are distinctly those of health departments, excluding expenditures for sewers, refuse disposal, and other activities which properly pertain to other departments of the city government.

range for individual cities being from $1.22 down to eight-tenths of 1 cent per capita. In New York City, where health work has been organized on an efficient basis longer than in any other American city, and where health appropriations are relatively generous, the per capita is 55 cents, but this is less than three-quarters of what the health commissioner certifies as necessary. The health department of that city has adopted the phrase, "Public health is purchasable, and within natural limitations a community may determine its own death rate." It is obvious that health appropriations the country over should be increased. This and expert service are the crying needs of the day. Given these, and effective organization and activity will follow. Aside from such general minima as have been mentioned above (which are merely suggestive), each community must estimate its own requirements in each department of public health activity and appropriate accordingly.

Public Health Surveys and Programs. — In the present pages we deal with the principles of public health practice, leaving these to be applied to local needs, which may differ rather widely in different places. It is the first duty of the health officer — if this has not already been done — to make a survey of the local public health situation, to study local needs, and to formulate an effective local program. In many instances it would be wise to secure the services of a public health expert for the special purpose of making such a survey.[1]

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[1] See the references to organizations specializing in such work, p. 63.

will frequently be cited in the following pages. Various other standard works on Hygiene may also be consulted. Of special interest to the health officer of the small town or country district is Brewer's "Rural Hygiene," Lippincott, Phila., 1909; also Dresslar, "Rural Schoolhouses and Grounds," U. S. Bur. Education, Bull. 12, 1914 (includes discussions on wells and privies).

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Kerr and Moll, "Organization, Powers and Duties of Health Authorities: An Analysis of the Laws and Regulations Relating Thereto in Force in the United States," U. S. Public Health Service, Pub. Health Bull. No. 54, 1912.

The publications of the Federal Government, particularly the "Public Health Reports" (a weekly statistical review of national health conditions, containing also articles on sanitary methods and organization, new municipal ordinances, etc., which may be obtained regularly by any health officer on application to the U. S. Public Health Service, Washington), and the Bulletins of the Hygienic Laboratory dealing with subjects of sanitary research and organization (may be obtained as above). The Department of Agriculture issues a monthly list of new publications, which will be sent regularly on request. For a general description of Federal publications see Price List 51, covering Health and Hygiene, obtainable from the Supt. of Documents, Government Printing Office, Washington, D. C., to whom requests for such publications should be addressed. Most of the Federal publications are sold at low prices in order to defray cost of publication.

Frequent reference is made throughout this book to the *American Journal of Public Health*, published by the American Public Health Association at 755 Boylston Street, Boston (subscription three dollars per annum), files of which are indispensable to the health officer. Previous to 1912 this publication was called the *Journal of the American Public Health Association*, and still earlier, the *American Journal of Public Hygiene*.

PART II

PUBLIC HEALTH ADMINISTRATION

CHAPTER I

COMMUNICABLE DISEASE

The most important group of duties falling to the health authorities is that under the head of communicable disease.

Terms. — It was formerly the custom to attempt to draw a precise distinction between the terms "contagious" and "infectious," but modern theory has shown the fallacy of such attempts. It is best to group all the diseases under present consideration under the term "communicable" (or "transmissible"), which means simply that they may be *communicated* from one person to another (or in some instances from an animal to man), and then to consider for each division the *mode of communication* of the disease. When it is seen that there are many such modes and many degrees of communicability, a much clearer and more practical conception will be obtained than through attempting to classify in hard and fast categories.[1]

Classification of Diseases. — The following classification, adopted from Rosenau's "Preventive Medicine and Hygiene" and based primarily upon practical sanitary considerations, is used in the present chapter.

[1] So far as the terms can be defined with any accuracy, "infectious" would seem to apply to any disease caused by microbic invasion (Latin *inficere*, to put into, to taint), while the term "contagious" would mean "capable of being spread by (direct or indirect) contact." In popular parlance a contagious disease is one directly and readily communicable — "catching"; while an infectious disease is conveyed in some indirect manner. Neither term, however, has an accepted *scientific* significance, and the terminology suggested in the text is much preferable. (Cf. Rosenau, "Preventive Medicine and Hygiene," 1913, page 317).

I. Diseases spread largely through secretions or discharges from nose, throat or mouth.
II. Diseases spread largely through excreta.
III. Diseases spread by insects and vermin.
IV. Diseases having specific or special preventive measures.
V. Miscellaneous diseases.

CONTROL OF COMMUNICABLE DISEASE

Reporting.[1] — Physicians, persons in charge of schools of any kind (including Sunday schools), and under certain circumstances, parents or householders, should be required, under heavy penalty, to make a prompt report of each case (or suspected case) of communicable disease coming under their observation. As a general rule there is no difficulty in obtaining good reporting of cases of the acute communicable diseases, though there is sometimes a tendency on the part of physicians to delay diagnosis for fear of being in the wrong. Reports of mild cases are also sometimes omitted where it is thought that unofficial home isolation will meet the situation; this is, of course, a very reprehensible practice, though apparently not of frequent occurrence.

It sometimes happens that a patient is affected with two or more distinct diseases at once — e.g., scarlet fever and diphtheria. Such cases are known as "plural infections." In such cases double records should be made out and the rules for both diseases apply.

Suspected Cases. — It should be distinctly understood that the public health should be given the benefit of the doubt in all instances: that cases may be reported as "suspected," that the health department will in such cases furnish a diagnostician (its own physician) to assume the responsibility of dealing with the case and settling the

[1] The English term "notification" is perhaps preferable, but the above is commonly used in this country.

doubt, and that in exceptional cases the diagnosis may, as a result of later developments, be recalled. It is preferable to isolate a suspected case for a few days rather than allow it the opportunity to infect half-a-dozen others during that time. Such cases should receive daily medical scrutiny with use of the thermometer.

Reportable Diseases. — The list of diseases which physicians are by law required to report is best fixed by state law, but is sometimes, to some extent at least, left to the local board of health to determine. It should include all of the diseases mentioned in the present chapter and any others which may concern the public health.

The reporting should be made as easy and systematic as possible for the physician. Postal card forms (except for tuberculosis, which the law frequently requires to be reported under seal) are most convenient.

It may, for epidemiological purposes, be useful to require in the report the name of the milk-dealer serving the family.

The practice of receiving reports over the telephone may be adopted provided prompt confirmatory notice is given in writing. It must be remembered that the law commonly requires the written report and that the latter is the proper legal justification for the action taken by the health authorities.

Defects in Reporting. — Satisfactory reporting of cases may be obtained through cultivating the coöperation of the local practitioners, explaining through circular letters and reports the necessity for prompt and full reports as a basis for the work of the health department. Occasionally prosecution of a grave offender is necessary. If the reporting is not up to the mark of practical perfection the fault may be laid at the door of the health officer himself, for upon him devolves both the power and duty of enforcing the law.

By practical perfection we mean the prompt reporting of all recognized cases. But even this does not mean that

actually all cases are brought to the attention of the health department, for, as will be explained later, there are numbers of "missed," or unrecognized, cases, which never reach the records.

Investigation and Action. — Reported cases are at once made the basis of investigation and action by the health officer or by a trained inspector. The importance of *promptitude* in looking up reported cases is very great; immediate isolation, for example, may save several cases or an outbreak later. Again, milk or other food supplies may be in need of prompt protection. The specific action to be taken for each disease will be outlined later under the various heads.

On his first visit the inspector fills out a blank form called a *history* of the case, on which are entered data concerning the circumstances of the case and possible sources of infection. He prescribes whatever measures are necessary in the case and adds to the history a memorandum of them. This history is then placed on file at the office for reference. It not only furnishes information, statistical and otherwise, but also, with the physician's written report, constitutes evidence of legal justification for the action taken.

Recording. — The recording system for communicable disease must be full, easy to manipulate, and afford ready means for any statistical studies that may be necessary. The system may comprise:

1. Original physicians' reports, filed in order of receipt.
2. History cards, filed by name or address.
3. A book record, giving main data of the cases in same order as physicians' reports, dates of action taken, etc.[1]
4. A "spot map," showing locations of cases.

[1] Columns may be provided for the following items: Name, Case No., St. and No., Age, Disease, Date of Rpt., Physician, Milkman, Date of Attack, Number of School Children, School Attended, Reported to School, Libraries, Milk Station, etc., Outcome of Case, Disinfection Measures.

5. Physicians' reports of termination of cases, filed in order of receipt.

Any good large-scale map of the town (such as may be obtained from the town engineer or a surveyor) may be used for the basis of the spot map; the various diseases may be indicated by tacks or pins having heads of different colors (those known as "routing tacks" and furnished by stationers are useful) and when a case is terminated the location may be marked by a colored spot. The map may be run for a year and then be replaced by a new one to be started afresh.

In addition to the above other forms will readily suggest themselves. Inspectors may, for example, run a record of inspections and disinfections performed. It may be desired to make special studies as to milk-supply, etc., but in general careful study of the above-mentioned records will give the essential understanding of the situation.

Notification of Schools, etc. — Cases of diseases of childhood should be reported promptly by the health department to the *school authorities* by telephone. The names of school-children in the house should be reported; if there are no school-children the report should nevertheless be made so that the school authorities may confirm the fact to their own satisfaction. Communication should be made as to whether the patient is isolated at home or has gone to the isolation hospital. Termination of isolation and return from hospital should be reported in the same manner. The relation of communicable disease to the schools will be discussed later (page 254).

The same data should be reported by telephone to *infants' consultation and milk stations* and public and private circulating *libraries* (page 263).

It may also be desirable to report to large milk companies the names and addresses of quarantined families on their routes.

If there is a local anti-tuberculosis society, *tuberculosis*

should be reported to it by regular arrangement. Care should be taken, however, that no legal provision is violated in so doing. The law usually provides that the data of tuberculosis reports shall be kept confidential, but there should be a proviso that they may be communicated by the health authorities so far as measures for the control of the disease require. Such a proviso would permit reports to unofficial anti-tuberculosis societies which would make the same sort of use of them that a health department might. Such reports should include statements of new cases, new reports of old cases, changes of address, deaths, disinfections and related facts. The records of the society may from time to time be checked over against those of the health department to see that they agree.

Reports made as above should be recorded in the communicable disease record book.

The reports required by law should also be made regularly to the state health department.

THE MODERN THEORY OF INFECTION

The great advances in sanitary science in the past few years have brought out the following principles, which are fundamental to all scientific considerations of the nature and transmission of infection. These principles are largely antagonistic to the older and now disproved theories of disease.

1. Communicable diseases are caused by definite and *specific organisms* (bacteria, protozoa, etc.), which are transmitted from person to person in various ways. Many of these organisms have been isolated and identified; of others, not yet isolated, the existence is inferred by the characteristics of the disease.

2. Cases of such disease *never arise spontaneously* (out of decay, etc., as once thought); the causative organism, derived from a previous case of the disease, must always be present.

3. However, it is now a recognized fact that the presence of the organism does not always produce the disease; in other words, *pathogenic organisms may often be harbored by persons who exhibit few or no signs of the disease.*

This last statement, involving the theory of mild or unrecognized ("missed") cases and "carriers," requires some explanation. It is known that the various pathogenic organisms vary in virulence; also, that the human subject varies in resisting powers. These facts were roughly formulated several years ago by Dr. Theobald Smith as follows:

$$D = \frac{M}{V},$$

in which D = the intensity of the disease, M = the strength of the microbic attack and V = the specific vital resistance of the person attacked; the greater the infection and the lower the vital resistance, the greater the intensity of the disease. The developments of more recent years have brought out clearly what might theoretically have been inferred from the formula, viz., that there are all degrees of intensity of disease, ranging from the most severe down to that so low that no disease can be detected. In other words, one subject, infected with a highly virulent strain of, say, *B. typhosus*, or having a very low vital resistance, may exhibit a highly severe case of typhoid fever; while another subject, also infected, but with a *B. typhosus* of low virulence, or else having high resistive power, may not exhibit any symptoms whatever. A person of the latter class, who, without exhibiting symptoms, harbors and sheds off organisms of a kind ordinarily pathogenic, is known as a *carrier*. A person standing between the two extremes, exhibiting some more or less mild symptoms, but not a typical case of the disease, would be an unrecognized or *missed* case. It is obvious that the last two classes of cases are highly dangerous factors in the spread of communicable diseases; much more so in fact than the recog-

nized cases which are under surveillance, for the latter — if the surveillance is adequate — are of practically no danger. Some authorities hold that the chief part in the spread of many of the common communicable diseases is played by carriers and missed cases. And indeed, if we include with the missed cases the effect of cases in early but infective stages of the disease, not yet recognized, the combined effect of carriers, unrecognized cases and incipient cases accounts fully for the continuance of communicable diseases even in communities where the surveillance of known cases is beyond criticism.

Since, then, "the clinical manifestations of an infection may vary from the typical description of the text-book to the very minimal dimensions which, possibly, only serological analysis can detect" (Ledingham and Arkwright), *the continuance and spread of a number of the communicable diseases is due to the following classes of infected persons:*

1. *Carriers* (no symptoms).
2. *Unrecognized* (*missed*) *cases* (mild or atypical symptoms).
3. *Incipient but infective cases* (undeveloped symptoms).
4. *Recognized* (*reported*) *cases* (known by more or less typical symptoms or bacteriological test).

To these might be added a small class, chiefly of the minor infections, which are recognized by family or physician but not reported as required by law.

THE CARRIER PROBLEM

The other classes need no special comment, but the carriers require special remark.[1] We may preface our remarks by saying that, of those persons classed as carriers in the widest sense of the term, by no means all carry virulent germs. Some strains of the diphtheria bacillus, for

[1] For a detailed treatment of the subject of carriers see Ledingham and Arkwright, "The Carrier Problem in Infectious Diseases," London, 1912.

instance, are non-virulent, as can be proved by laboratory tests on animals. While this is a fortunate fact, it somewhat complicates the matter, for it is not always feasible to make the tests necessary for distinguishing. In our discussion of carriers we shall assume that most are carriers of virulent germs and that all are at any rate suspicious.

There are in general two kinds of carriers. First, those who have had a recognized attack after which the person continues to harbor and shed off the germ; these are the *chronic carriers*, to the agency of which a number of epidemics have been traced in recent years. Chronic carriers are not infrequently "intermittent" carriers, i.e., there are periods when they are shedding germs and periods when they are not; this is a fact of special importance when a search is being made for carriers, for a person examined during a non-shedding period may show negative results and be let off without suspicion. Secondly, there are persons who become infected without showing any symptoms and harbor the germ for a short time without apparent ill-effects to themselves; these are called by recent authorities *transitory carriers*.

As to the frequency of carriers of the various diseases:

> Even when diphtheria is not prevalent 1 per cent of the population may be carrying the bacilli, and during outbreaks the number may be several times greater. Probably 25 per cent of all typhoid fever cases excrete bacilli for some weeks after convalescence,[1] and it is estimated that from 1 in 500 to 1 in 250 of the population are chronic carriers. . . . There is no evidence that there are many carriers of measles or smallpox.[2]

The same authority estimates that 20 to 50 per cent of the population carry pneumococci and that the influenza bacillus is as widely distributed. In epidemics of cerebro-

[1] 12 per cent (10 in 86 cases) have been found to be carriers three months after defervescence (experiments of Semple and Greig, 1908). — J. S. M. (Cf. however p. 200 of present volume.)

[2] Chapin, "Sources and Modes of Infection," 1912, p. 132.

spinal fever the carriers may be ten to thirty times as numerous as cases. In yellow fever, and especially in malaria, carriers may be numerous. In one-third to one-half the recovered cases of cholera the vibrio may be detected for more than ten days, though persistence over one month is very exceptional (Ledingham and Arkwright). In dysentery there are doubtless numerous carriers; this disease being comparable with typhoid fever, though the persistence of infection appears not to be so long. On the latter two diseases there is comparatively little evidence. Scarlet fever seems to be comparable to diphtheria in numbers of carriers. The many only partly cured cases of gonorrhœa and syphilis may be classed as carriers.

While the data on carriers are by no means full (especially in those diseases of which the causative germ is unknown) the evidence shows the great part which they must play, and explains the failure of the present isolation measures to obliterate the common communicable diseases. The presence or possibility of carriers and missed cases must always be borne in mind by the health officer. It is in this direction that future progress in control methods is to be looked for.

In the possible cure of carriers little advance has as yet been made. In typhoid fever the germ-bearing urine may be internally disinfected by means of the drug urotropin, which is useful both in diminishing the incidence of the bacilluria and in curing it when established. When germs exist in the nose and throat it is possible that their numbers and the amount of danger may be diminished by the use of antiseptic sprays and gargles (e.g., hydrogen peroxide), both by the carrier and by persons in association with him, or by special medical treatment to cleanse and disinfect the crypts of the tonsils. The efficacy of such measures for ridding the throat of germs does not, however, appear as yet to be thoroughly established.

The *supervision* of carriers is a difficult matter, but one

now recognized as a duty of health authorities.[1] In the case of carriers of diphtheria, where the germs usually disappear (or may be made to disappear) in a few days, isolation is feasible, especially with school-children. There are, however, two kinds of carriers: (1) those existing in the general population and giving no history of having been in contact with a sick person; such are usually carriers of germs of little or no virulence; (2) those who have had the disease or who have been in recent association with cases; these are the chief carriers of virulent germs and the class most to be watched by the health officer. Thus it is not feasible to isolate all carriers — say of diphtheria — in a community, though it is feasible to search out and isolate all school-children carriers in association with a known case of the disease. In the former case the isolation would be in many of the cases needless if not impracticable, but in the latter case we are isolating and excluding from school presumably virulent carriers in the class in which diphtheria is most easily spread, viz., children of school age.

When the condition of germ carriage persists a long time, as in typhoid fever, it is practically impossible closely to restrain the carrier. In such cases it seems best to warn the carrier as to the danger of infecting other persons, to instruct him as to habitual and scrupulous cleanliness of the hands, and to maintain a sufficient degree of surveillance over his movements to see that he does not engage in handling foodstuffs or otherwise spread the disease. The last requirement would necessitate his submitting at certain intervals to some sanitary authority for bacteriological examination of discharges and renewal of instructions. Since such carriers may remove from towns or even from the state, such surveillance might perhaps best be exercised by state health authorities in coöperation with one another.

[1] Cf. Sawyer, "The Prevention of Carriers," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 3, p. 217.

It is of the greatest importance that local health authorities be constantly on the lookout for carrier cases in the diseases in which bacteriological methods are available, — i.e., especially diphtheria and typhoid fever. When such cases are discovered they may be dealt with locally or — as suggested above — in coöperation with the state authorities. There should also be a steady effort — especially through the extension of medical inspection in schools and even in dwellings in which known cases exist, and through extension of bacteriological diagnosis — to detect those mild and atypical cases which would otherwise be missed cases. It must be remembered that physicians sometimes fail to report mild cases, yet these (with the carriers) are just the class which are most potent in spreading disease and most in need of effective control.

THE SOURCES AND MODES OF INFECTION

SOURCES OF INFECTION

The causative organisms of the various communicable diseases are shed off in the excreta of the patient (e.g., typhoid fever), in the secretions of the upper respiratory passages (diphtheria, scarlet fever), in the sputum coughed up from the lungs (pulmonary tuberculosis), or in the products of sores (venereal disease). The desquamation (scales) from the skin may be infectious (e.g., in smallpox).[1] The germs may also exist free in the blood of the patient and be carried to the victim through the medium of a blood-sucking insect (e.g., malaria, infantile paralysis).

MODES OF TRANSMISSION

Infection may be conveyed from person to person in the following ways:

[1] Contrary to former belief, modern evidence indicates that the desquamation plays little or no part in the transmission of scarlet fever and measles. These diseases may be classed with diphtheria as being spread probably entirely by the secretions from the nose, throat, respiratory passages and ear. (Cf. pp. 148, 151.)

1. **Contact.** — *By contact infection is meant the transference of infectious matter from person to person directly and immediately, or nearly so.*[1] For "contact infection" in this sense it is not necessary to have the actual touching of the person which the terms "contact" and "contagious" are popularly taken to signify.

Contact infection is the most obvious mode of transmission of the infectious diseases . . . the evidence is that it is the chief mode. . . . If contact infection can explain epidemiological phenomena, there is no occasion for assuming the growth of pathogenic germs outside of the body, or of infection by fomites or infection by air, or any other similar theory, and no such theory should be adopted as a working hypothesis unless pretty strong evidence can be brought to its support. (Chapin.)

Just how does contact infection take place? The contact may be of the perfectly direct type, as in venereal transmission, but the more or less indirect types are of more importance to the sanitarian. There are countless ways in which unseen but dangerous amounts of discharges — oral, nasal, intestinal, urinary, etc. — may be passed from person to person. The starting point is the infectious person, whether he be a recognized patient or a carrier; the ending point is the portal of infection of some other person — usually the mouth. "Perhaps 90 per cent of all infections are taken into the body through the mouth" (Rosenau), directly from the fingers or with food or drink.

Among specific factors in contact infection, *fingers* play the chief part. The fingers of all persons, both sick and well, readily become contaminated with the various discharges, — much more readily and frequently than is generally imagined. From Chapin, who presents the evidence in detail, the following extracts (as well as the one above) are taken.[2]

[1] *Important Note.* — Whenever the term *contact* as a mode of infection is used in this book, it is to be taken, not in the limited popular sense, but in the above special sense.

[2] "Sources and Modes of Infection," 1912.

First, as to finger contamination with excreta:

It appears that the fingers of human beings, and secondarily everything that the fingers touch, are frequently contaminated with excremental matter. . . . It appears that the fingers of careful people, and even of trained nurses, are infected in this manner. . . . There is much evidence that this mode of transference is an important, if not the most important, factor in the spread of [typhoid fever].

Again, as to contamination with the secretions of the nose and mouth and with the sputum:

If one takes the trouble to watch for a short time his neighbors, or even himself, unless he has been particularly trained in such matters, he will be surprised to note the number of times that the fingers go to the mouth and the nose. . . . Who can doubt that if the salivary glands secreted indigo the fingers would continually be stained a deep blue, and who can doubt that if the nasal and oral secretions contain the germs of disease these germs will be almost continually found upon the fingers? . . . In this universal trade in human saliva, the fingers not only bring foreign secretions to the mouth of their owner, but there exchanging them for his own, distribute the latter to everything that the hand touches.

But there are also other modes of contact infection:

Another important vehicle of transfer must be the common drinking cup. . . . The mouth is put to numberless improper uses which may result in the spread of infection. It is used to hold pins, string, pencils, paper and money. . . . Children "swap" apples, cake and lollipops. . . . Children have no instinct of cleanliness, and their faces, hands, toys, clothing and everything that they touch must of necessity be continually daubed with the secretions of the nose and mouth. It is well known that between the ages of two and eight years children are more susceptible to scarlet fever, diphtheria, measles and whooping cough than at other ages, and it may be that one reason for this is the great opportunity that is afforded by their habits at these ages for the transfer of the secretions. Infants do not of course mingle freely with one another, and older children do not come in such close contact in their play, and they also begin to have a little idea of cleanliness.

Another variety of contact infection is "droplet infection" through the spray and droplets thrown out of the mouth and nose in coughing, sneezing and loud speaking. Such

infection may take effect within a short radius — say five or six feet from the person — much more rarely in more distant parts of the room.

Food and drink, and other articles may readily become infected, and if these convey an immediate infection, it may properly be regarded as a kind of contact.

Persons may act as "go-betweens," conveying infection — without themselves having the disease — from sick to well; this is a kind of indirect contact infection. They may also convey by acting as carriers in the true sense. Nurses of communicable disease must therefore be regarded as potentially infectious.

Such considerations apply to the whole community and explain why diseases spread by contact readily go through a family but do not so readily pass between families having no direct association. They also show why carriers and missed cases in a community are potent means — frequently the chief means — of spreading disease.

In arguing the importance of contact infection relatively to other modes Chapin adduces two points of evidence: "the restriction of scarlet fever and diphtheria to single families in the same house, and the success of certain hospitals in preventing cross-infection, when contact infection is strictly guarded against."

The *preventives* of contact infection at large are evident. *Personal cleanliness* is the prime desideratum and should be taught and encouraged so far as practicable by health and school authorities.[1] The care of the hands is especially important. The point is emphasized in a popular manner in the following: [2]

THE IMPORTANCE OF KEEPING HANDS CLEAN

Probably the commonest way in which infections are implanted within our bodies is from hand to mouth.

[1] See rules on p. 263.

[2] Bull., Chicago School of Sanitary Instruction, Nov. 1, 1913. Cf. p. 585 of present volume.

Our hands are more or less constantly coming in contact with infectious matter and they are more or less constantly going to our mouths; if not into them they handle and infect the things which are put into them.

It is, therefore, intensely important that we shall always keep our hands as clean as possible by frequent washing.

Hand washing is necessary:

Immediately before eating.

Immediately before handling foodstuffs, in course of preparation or serving.

Immediately after necessary toilet attentions.

Immediately after handling the sick or articles from a sick room.

Immediately after handling any dirty article.

Persons charged with the preparation or handling of foodstuffs and those engaged in the care of the sick should be especially careful about their hands. A cook with dirty hands is liable to infect every person who eats the foods she handles. A nurse with infected hands can readily spread disease.

In washing give special attention to the cleansing of the spaces under the fingernails. Use lots of soap, warm water and a good hard bristle brush.

Keep your hands clean and you will avoid many unnecessary infections.

Look to your cook's hands — that's a test of her efficiency and of your safety at her hands.

Immediately dismiss a nurse who is careless about the condition of her hands.

These are simple, every-day matters — but they count mightily. Dirty hands will hand you trouble.

Again, in special relation to typhoid fever, the following:

As far as unclean hands are concerned, our course, as regards typhoid infection, would seem to resolve itself into the two following propositions: first, that inasmuch as no person can be absolutely certain that he is not a typhoid carrier (for, of course, it is well known that a healthy human being, and especially those attendant upon typhoid patients, may become a temporary typhoid carrier, even though he has not suffered from the disease itself) every one should, as far as possible, wash his hands with scrupulous care after any possible contamination with feces or urine, and, secondly, that no one should think of handling food, either for his own use, or for others, without carefully washing his hands.[1]

[1] Richardson, " Dirty Hands and Typhoid Fever," *Am. Jour. Pub. Health*, 1914, vol. iv, no. 2, p. 140.

The simple precaution of following the above rules would automatically protect the individual and his neighbors and nearly if not entirely eliminate certain of the common communicable diseases. But so long as such precautions are neglected by the vast majority of the public, just so long will disease continue to be spread by carriers and missed cases.

In the sick-room and hospitals such considerations apply with special force. There scrupulous cleanliness, with the use of disinfectants as an additional safeguard, must constantly be practiced.

As an example of the modern "aseptic" method of preventing contact infection in common diseases, and practical disregard of air infection, the following remarks, referring to the Providence City Hospital, may be quoted:

> The authorities in the Providence institution believe that air-borne germs play a very small part in the dissemination of disease, and the barrier that is set up against the spread of infection is literally a "fight at the bedside of the patient." The figures show that this has been done with success. . . .
>
> [Gowns] are put on when there is occasion to approach closely to the bed or touch the patient, and taken off and the hands washed before leaving that patient. . . . If a visitor touches anything in the room the hands must be washed. For measles and one or two other maladies whose precise method of infection is not understood the disinfectant is used after washing. . . .
>
> The features of the Providence City Hospital, then, that are novel are these, that, in a hospital for communicable diseases, the fight is made absolutely at the bedside of the patient, that the infection is considered as stopping there. The corridors are believed to be as free from contagion as those of any general hospital. And even into the wards and rooms a City Father in discharge of his duties of inspection could safely go. Ingress and egress from the hospital are practically free and in fact much of the machinery and red-tape that surrounds hospitals in general is eliminated in Providence. And there is furthermore the belief in the cleansing properties of soap and water that obtains almost nowhere else. Walls that may be thoroughly cleaned, floors of battleship linoleum that is resilient, durable and hygienic and the cleansing of wooden floors so well that infection from the dust

is negligible, furnish an outfit that supplements the care practiced by all who enter. . . . [1]

Of course it must be remembered that the above refers to a hospital where aseptic measures not generally practicable in private dwellings may be enforced. With communicable disease in dwellings disinfectants must be relied upon to remedy deficiencies in the cleanliness which is so strongly argued above, but which in general sanitary practice is as difficult to obtain as it is simple to recommend.

2. **Food and Drink.** — Various articles of food and drink readily act as vehicles of infection, and may be classed as second only to contact infection in importance. Milk, on account of its liability to contamination and its property of nourishing or at least preserving pathogenic organisms, is especially liable; as is also water, which is readily polluted and may scatter infection broadcast. Many serious epidemics have been traced to milk and water infection. Hence such supplies are properly subjected to special protection. This mode is, of course, essentially an extension of contact infection to a wider circle of effect, so that measures against contact infection also help to protect food and water supplies.

3. **Fomites.** — If germs are transferred from person to person by means of some object directly and without delay — or nearly so — the process is called, as already stated, contact infection. But if such objects retain infection for some time and then transmit it they are known as fomites.

A toy used by a diphtheria patient and sent to a distant town and there giving rise to the disease, the dress of a scarlet fever patient put away for weeks or months and brought out only to cause another case, a library book carrying the infection of smallpox from one household to another, . . . and the various objects in a room lately occupied by a case of any contagious disease giving rise to the same infection in

[1] *Boston Transcript*, "The Clinic" column, May 28, 1913. Cf. Chapin, "Studies in Air and Contact Infection at the Providence City Hospital," *Am. Jour. Pub. Health*, 1912, vol. ii, no. 3, p. 135.

newcomers, would all be recognized as fomites. The cup which carries the moist saliva from one school child to another, the borrowed pencil which transfers the fresh syphilitic virus from lip to lip, and the urine-moistened closet seat which infects the fingers and then the mouth of the next user, are not thought of as fomites but as the necessary media for that intimate mode of disease transference which is coming to be called contact infection. This distinction between the two classes of bearers of infection is somewhat arbitrary, and not very definite, but is eminently practical. . . . By infection by fomites is meant a transference of infecting material on objects under such conditions that considerable time elapses, days at least, usually weeks, sometimes months.[1]

Fomites infection as thus defined is considered by modern authorities to be of much less importance than was formerly supposed. About the only exceptions to this statement are anthrax and tetanus (q.v.). Chapin summing up the evidence concludes that "there is no good epidemiological evidence that any diseases except those due to spore-forming bacteria are to any great extent transmitted by fomites," and that "other modes of transmission so much more satisfactorily account for the spread of disease, that there seems to be really little opportunity for infection by fomites."

In any event measures which prevent contact infection also prevent any possibility of fomites infection which may exist.

4. **Air.** — Air was formerly considered the chief vehicle of infection, but now, like fomites, it is regarded as of far less importance than tradition has held. "There are only two diseases of man, viz., smallpox and measles, which may possibly be air-borne, in the sense that this term is generally used. . . . The more the transmission of the communicable diseases is studied, the less the air is implicated." (Rosenau.) Even with smallpox and measles there is a great deal that is obscure, and strict aerial transmission does not appear ever to have been clearly demonstrated.

[1] Chapin, *op. cit.*

There is on the other hand evidence that air transmission in a rough sense does sometimes occur through the conveyance of germs on floating atmospheric particles (dust or droplets). Droplet infection, however, is logically allied to contact infection (see above). As for the theory of transmission by dust, it is supported by some evidence, especially in regard to tuberculosis; but the dangers are apparently relatively small — at any rate much less than was formerly thought.

It is an interesting fact, incidentally, that expired air, once thought virus-laden, is proved under normal conditions of respiration to be sterile.

It may be concluded that if the measures necessary to prevent contact infection are taken, the danger of infection by air (including dust), with the possible exceptions noted, may practically be disregarded.[1]

5. **Insects.** — Infection through insects is a mode which stands quite distinctly by itself. Malaria, yellow fever, plague, and other diseases are transmitted through the bites of specific insects, which act in such cases as "intermediary hosts" of the diseases. The insects involved are the malaria mosquito, the yellow fever mosquito, the plague flea, etc. Prevention involves suppression of the insects and, as a temporary measure, protection of the patient from access by them. Flies and other insects may also convey infectious material mechanically, as on their legs, but this is logically classed as a kind of contact infection. The ordinary cockroach has recently been shown capable of so conveying infection.

6. **Special Modes.** — Certain *special modes* of transmission may be added. Thus, rabies is transmitted directly by the bite of the rabid dog or other animal; anthrax is

[1] The subject is admirably discussed by Chapin: "The Air as a Vehicle of Infection," *Jour. Am. Med. Assn.*, 1914, vol. lxii, no. 6; and "The Relative Importance of Aerial and Contact Infection," *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. IV, pt. I, pp. 9–17.

most often transmitted from cattle to man by infection of skin lesions by the bacteria in hides; and hookworm is usually contracted through contact of bare feet or hands with polluted soil.

When third persons convey infection from sick to well, it may either be by contact (e.g., by medium of the hands) or such persons may be true carriers of the germ, i.e., harboring it themselves.

In conclusion, as the chief mode of transmission of infection we must rank contact in the broadest sense of the term. Milk and water supplies are also of great importance. Then come the disease-bearing insects, which, however, are somewhat localized in distribution. Lastly, of distinctly minor importance — so much so that in practice they can be almost entirely disregarded — come air and fomites infection as commonly understood; for it has been shown that much of the supposed air and fomites infection is in reality due to contact and the other modes of transmission.[1]

[1] Valuable evidence as to the importance of contact and the relative non-importance of aerial and fomites infection is found in the experience of the Providence City Hospital, which is operated on the principles advocated by Chapin. In that institution some cases are isolated in rooms and some in wards with mere barriers, to act as warnings, between the beds. The rooms open into a common corridor and the doors are always open, the nurses going from case to case. No disinfecting solutions are used for the hands, but strict cleanliness of the hands and aseptic precautions are insisted upon. The same nurse attends cases of different diseases. In the 18 months ending September 1, 1911, there were but 7 cases of cross-infection among 365 patients in rooms. "These figures, which show fewer cases of cross-infection than in many isolation hospitals under the old system, make strong evidence against the theory of air-borne infection. . . . It appears then that the chief means of spreading infection is not through the air or by means of fomites, but by means of contact either with carriers or the patients themselves." (Rpt. Committee on Communicable Diseases of Am. Pub. Health Assn., *Am. Jour. Pub. Health*, 1912, vol. II, no. 2, p. 119.) Cf. Doty, "The Control of Disinfection and the Influence of Infected Rooms and Fomites in the Dissemination of Various Infectious Diseases," *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. IV, pt. I.

Summary. — The following summary shows some of the more important points in which modern practice differs markedly from the traditional:

1. *Transmission of infection:* emphasis to be placed upon contact, food, drink and insects. Air and fomites infection of little or no importance.

2. *Isolation:* value lessened by presence of carriers which escape isolation; has, however, a definite use in restriction or spread of infection. A reasonable isolation adapted to the individual case usually preferable to rigid and sweeping quarantine regulations.

3. *Disinfection:* chemical disinfection used as a precaution additional to scrupulous sick-room cleanliness. Infectious matter to be destroyed at the bedside; terminal disinfection of comparatively little, where any, value.

4. *Laboratory methods:* increased use of the laboratory for diagnosis, treatment and prophylaxis (through sera), and determination of time of release of cases of communicable disease.

5. *Chief administrative problems:* control of carriers and of incipient and missed cases; lack of exact knowledge as to channels of infection.

6. *Control by principles rather than rules.* In the past it has been the practice of health authorities to formulate inflexible rules for the control of communicable diseases. Some such rules are practically necessary, yet to-day we see that good judgment in the health official is more important than blind adherence to traditional methods *provided* he has the thorough knowledge of public health science upon which to base that judgment.

A public health official should be practically familiar with the infectious diseases, and with the means by which they are transmitted from one person to another, and he should not accept theories relative to the latter unless they are supported by scientific evidence. He must have the courage of his convictions in his efforts to protect the public health and should carry out only such measures as are reasonable and practical. Attempts to secure complete safety by unjustifiable or

spectacular methods usually defeat the end in view, and are not in accord with modern sanitation. . . .

Success in public health work . . . is frequently obstructed by attempts to follow specific rules and regulations in the management of outbreaks, etc., instead of being governed by the principles of sanitary science, a practical familiarity with which will enable a health officer to cope intelligently with any condition or emergency which may present itself. Specific rules and regulations never accurately fit all cases, and if followed tend to make a health officer an automaton. Whereas, if the principles upon which sanitary science is founded are fully understood and acted upon, but comparatively few rules or regulations are necessary. A policy of this kind, which deals in a practical manner with all measures relating to the public health, causes the minimum amount of annoyance to the public and to commerce.[1]

I. DISEASES SPREAD LARGELY THROUGH SECRETIONS OR DISCHARGES FROM NOSE, THROAT OR MOUTH

In this class of diseases the first preventive measure applied to known cases is to *destroy or disinfect the discharges in the sick-room and without delay*. This must be done by an *efficient nurse*, who observes scrupulous *cleanliness* of all objects in contact with the patient, and especially of *her own hands*. The latter two measures we shall refer to hereafter as *prophylactic cleanliness*. As an additional precaution, association with the patient is to be prevented through *isolation*. All of these diseases may be spread primarily by *contact*,[2] and secondarily, in some instances, through food and drink.

We shall now describe what is meant by disinfection and isolation, so that it will not be necessary to repeat the details under the head of each disease.

Asepsis and Disinfection. — The destruction or disinfection of the infected discharges and of articles infected by them, during the course of the disease, in the sick-room or as near to it as possible, and without delay, is the great-

[1] Doty, "Prevention of Infectious Diseases," 1911, pp. 20–22.

[2] See note, p. 113.

est single measure that can be adopted for the prevention of the spread of infection from the individual case. If this one measure were thoroughly carried out, in combination with proper isolation of the patient, the transmission of disease from known cases would be reduced to nil. In Appendix A will be found detailed instructions for disinfection.

The necessity for such immediate and direct disinfection and for the maintenance of a clean and practically germless condition of the nurse's hands should be impressed by the health department officer who establishes the isolation. The processes for reaching the desired results should be explained in detail and arrangements made as to the vessels, etc., to be used. Health departments should, moreover, furnish free or at cost the disinfectants needed, as otherwise families are likely to obtain ineffective materials or stint in their use.

Isolation. — Isolation of the patient is a protective measure, the value of which rests upon the fact that in practice the disinfection of all discharges cannot be insured, and that persons, if they were not excluded from the patient, would become infected by contact with the patient or with undisinfected discharges or articles contaminated by them, both of which are common to sick-rooms. Also, as in smallpox and measles, a slight contact with the patient (or possibly air infection) may be sufficient to result in transmission.

The following may be taken as the principal points of a proper isolation:

1. *The room* chosen for isolation should be in as retired a part of the house as possible, preferably in an upper story, away from living and dining rooms and kitchen. It should contain no unnecessary furnishings, and carpets, curtains, upholstery and the like should so far as practicable be removed.

The door should be kept closed and a small placard may

be placed upon it as a deterrent to children and other possible intruders; this will serve the same purpose as the usual disinfectant sheet over the door, which is of no demonstrable value (see air infection, page 119 f.).

The sick-room should be screened, if necessary, to exclude flies and other insects. Flies in and about the sick-room should be killed as being possibly infected. Animal pets which are fondled by children may carry infection. It would be wise to give pets which have been so exposed a thorough washing. They may be isolated with the patient provided they are not allowed to pass out and mingle with the rest of the family, and should be washed at the close of the isolation. Cats should be regarded with suspicion as they are known to become occasionally true "carriers" of diphtheria, the infection being seated in the nose of the animal.

2. *One* person — preferably a trained nurse — should act as *nurse* and should be isolated with the patient. If the mother of a family endeavors to act as nurse and at the same time cook and care for well children in the family, she is likely to infect the latter unless extreme care is taken.

Upon the nurse devolves the responsibility for cleanliness and disinfection, and for maintaining strict isolation. If she has to leave the room she should have no association or contact with other members of the household. Other persons, with the exception of physician and clergyman, should be excluded.

The nurse should be a person of sufficient intelligence and should be instructed in detail by the inspector. Printed circulars of instruction are useful for educated persons, but cannot in any case dispense with personal instruction.

The nurse should guard against "contact" infection of the various kinds including "droplet infection." Thorough washing and disinfection of the hands is a prime essential. If the person acting as nurse cannot be isolated

with the patient, she may wear a gown or wrapper and a head covering while in the sick-room, putting it off at the door when leaving the room. Care should be taken in regard to possible infection of the bath-room and toilet, e.g., through disposal of discharges. Patient and nurse should, if possible, have a bath and toilet separate from the rest of the family.

The nurse must see that all discharges which may convey infection are promptly disinfected or burned. Articles (including eating utensils and remnants of food) which may be infected must receive similar treatment. The disinfection should so far as possible be performed in the sick-room, but it may be more convenient to place dishes, bedding, and the like in a vessel outside of the door, to be disinfected, e.g., by boiling. More reliance is to be placed in fire and heat than in chemical disinfectants, which may be expensive, dangerous, inefficient, or not adapted to use by unskilled persons.

Finally, if a proper home isolation cannot be assured, the patient should be removed to the isolation hospital.

Quarantine. — We come now to the measures which apply, not directly to the patient, but to the persons about him and to the dwelling itself.[1] Although the best modern practice lays less stress on quarantine or even isolation than on proper asepsis and bedside disinfection, nevertheless quarantine measures, especially as applied to possible carriers in the family of the patient, are important. The following points pertain to quarantine:

[1] The terms "isolation" and "quarantine" are frequently confused. Isolation (or segregation) refers to the restrictions directly surrounding the patient. Quarantine is a broader term which covers measures applied to the premises and household. The terms are used in the present chapter in those senses. Quarantine in a still broader sense refers to restrictions placed on an area of some magnitude. Thus there may even be a national quarantine. The term applies in a special sense to the measures taken at ports to prevent introduction of infection from foreign ports and at foreign frontiers.

1. It is customary to *placard* both front and rear of a quarantined house or apartment, with the warning that visitors are not to enter. If there are other families in the same house — e.g., a tenement — it is usually unnecessary and impracticable to apply the quarantine to families other than the one in question, but the quarantine of that family must be made perfectly clear. The placard warns persons not to pay visits or associate with members of the infected family, and the rear door sign is a special warning to the milk dealer.

2. *Milk bottles* should not be permitted to enter or leave the house during the period of quarantine. It is a frequent custom to forbid milk dealers to leave bottles where there is a placard, but to pour the milk into a pitcher or other vessel put out by the family. There are some disadvantages in this: the vessel is subject to contamination and the uncapping of the milk by the delivery man is undesirable. Hence it is better to permit milk to be delivered in bottles to quarantined families, with the proviso that no bottles be removed by the dealer. Then at the termination of the quarantine all bottles which have accumulated are disinfected (e.g., by boiling) under the supervision of the inspector, and returned to the dealer.[1]

3. In the restrictions on *members of the household* discretion based on principle, rather than rigid rules, is required. It may, however, be necessary to lay down certain rules for the guidance of inspectors.

The chief restrictions usually apply to *children*. Under the heads of the various diseases will be indicated the exclusion measures applicable to school children; those not yet of school age should be restricted correspondingly. Children who have not had the disease may sometimes be sent to live elsewhere with relatives and thus be readmitted to school sooner than if they stayed at home

[1] Rule of Mass. Assn. of Boards of Health, *Am. Jour. Pub. Health*, 1912, vol. ii, no. 12, p. 996.

to await termination of the case. The quarantine of children should forbid their going off the premises or associating with children of other families.

If isolation is good the restrictions on adult members of the household need not be onerous. Certain members may be given permits to leave the premises to go to work, purchase supplies, etc. *Working persons* need not ordinarily be kept from work unless they are concerned with the handling of foods capable of becoming infected, viz., cooks, waiters, bakers, confectioners, etc. Such persons may be required to live away from home during the period of quarantine unless the case is removed to the hospital. As regards school-teachers, conductors, barbers and other persons whose work involves some degree of personal contact, if the isolation is good there seems to be no sufficient reason for keeping such persons from their occupations. If there is any real question the case may be sent to the hospital or such persons may go to live elsewhere during the period of isolation. Each case should be judged on its merits, and uncalled-for hardship should not be imposed, bearing in mind that healthy adults rarely act as conveyors of disease unless the degrees of contact at both ends of the line are intimate.

4. As to *other families in the same house*, the restrictions may be less strict and should be based upon the probable degrees of association between families. The children are, of course, the chief consideration. If there is a good isolation of the case, and children in the quarantined family have positively not been exposed and keep to themselves, there need perhaps be no restrictions on the other families. But if it seems possible that there has been exposure, the children in such families should be kept out of school until the incubation period of the disease has expired or until (in diphtheria) negative cultures have been obtained. On the other hand, association between children in different families may be nearly — if not quite — as intimate as

between children in the same family. If any continued association between families is suspected, the children from all families should be excluded from school and kept on the premises. Adults in the other families need not, as a rule, be restricted, but may be warned to exercise proper control over their children. Since this is frequently impracticable, as in a tenement, much the better plan is to remove the case to the isolation hospital. A loose so-called quarantine of a large number of persons in a house is impracticable and its failure subversive of authority. Of course, in all cases members of associated families should be carefully watched for development of cases, and a search should be made for carriers and unrecognized cases when suspected. (For specific rules, see under the various diseases.)

If an effective isolation and quarantine cannot be obtained at home the patient should be removed to the isolation hospital and possibly infected surfaces and articles should be promptly disinfected (see Appendix A). Hospital removal is desirable also when a case is found in a lodging-house or institution. Even in many instances where home isolation is perfectly feasible there are protection and benefit to the community and family and advantages to the patient in proper hospital treatment (see later, under the head of Isolation Hospitals).

Revisits to Cases under Isolation. — In many instances it will be found advisable for the inspector to revisit cases which have been placed under isolation. Otherwise, in careless families or with mild cases, there is a great likelihood that the measures prescribed will not be entirely and effectively carried out. Even careful and intelligent people frequently need additional advice and guidance, and may get into difficulties if left entirely to themselves for an entire isolation period. The following practice may be adopted: Revisit each case (diphtheria, scarlet fever, etc.) within 24 hours after the first visit; revisit again, if neces-

sary, after three or four days; then revisit at intervals of a week or so. The frequency of revisits must vary greatly according to the circumstances of the case; the recommendation just given might apply to an average case; some might require daily visits; others with excellent conditions no revisits at all. The revisits should be at irregular intervals and unexpected times, and should, in general, be made more frequently in the beginning of the period.

Revisits may be indicated in the inspector's daily or weekly reports, and may be shown upon the spot map of communicable disease as follows: on each pin or tack representing a case hang a small tag (price-tags are useful), upon which dates of revisits may be noted in abbreviated form.

Application of Principles. — The foregoing is not intended to serve as a complete code for isolation and quarantine, but simply to indicate the main considerations, which may be covered by any detailed rules that may be necessary.

In imposing restrictions it is the natural and proper tendency of health officers to be on the safe side. It should, however, be remembered that not only the risk avoided, but also the damage or inconvenience incurred must be considered; and if the former is not commensurate with the latter the restriction is unjustified. While the first duty is to the public, the individual should not be unduly burdened. Moreover, if restrictions are unreasonably severe, disregard and disrespect are encouraged. Rigid traditional rules should give way to a flexible application of the principles of sanitary science, especially since the newer theories of infection have shown the limitations, ineptitude, or even the uselessness of the traditional cast-iron rules. The hardships and losses entailed by over-rigid measures — i.e., through destruction of property, restraint of persons from business and school, nursing, etc. — should be considered.

It scarcely needs be said that *mild and atypical cases* should be subject to the same measures as the severe and typical. It is just such cases that are most implicated in spreading disease. This is a point which the public does not understand. Mild cases may give rise to severe cases and *vice versa*.

Surveillance of "Contacts." — By contacts we mean persons who have been exposed to infection through direct or indirect contact with the patient. Such persons may or may not develop the disease. One of the important duties of the sanitary officer is to determine what persons among the associates of the patient should be considered as contacts, and to keep them under surveillance. A careful history of the case obtained by questioning patient and family should indicate the chief contacts. The main point in the surveillance is not usually personal restraint, but periodical medical observation. Thus children in a family where a communicable disease exists should be watched carefully, and be examined, say daily at first. This is a matter usually left to the attending physician, but when there is no physician, as when the contact is in another family and the family of the suspect does not see fit to obtain its own physician, it may be desirable for the board of health physician to oversee the person. It is feasible, of course, to apply the surveillance only to those cases where there is a considerable chance of the disease developing. It is to be maintained until the maximum incubation period has elapsed since exposure. Such a period may be ascertained from Table III at the close of this chapter.

Terminal Disinfection. — Custom has held that one of the chief safeguards against spread of infection is terminal disinfection. By this is commonly meant gaseous disinfection ("fumigation") of supposedly infected rooms and articles after termination of isolation through death or recovery of patient. The practice is based principally upon

the theories of air and fomites infection, both of which, as has already been stated, are now largely discredited; and in recent years both theoretical and practical reasons have been brought forward to show that terminal disinfection as commonly practiced is of very much less value than formerly supposed.[1]

The argument against such terminal disinfection is based chiefly upon the following facts: the low vitality of many pathogens outside of the body; the prevalence of communicable disease to the same extent where such disinfection is efficient as where it is inefficient; and the non-increase of the disease in instances in which such disinfection has been abandoned. In Providence, R. I., terminal disinfection has been abandoned after certain diseases except when requested by the family; thus the number of disinfections has been much reduced without any apparent ill result (see Providence health report).[2] In New York City

[1] Chapin, "Sources and Modes of Infection." Also: Chapin, "The Value of Terminal Disinfection," *Jour. Am. Pub. Health Assn.* 1911, vol. I, no. 1, p. 32; Rpt. Supt. Health (C. V. Chapin, M.D.), Providence, R. I., for 1912, p. 96 ff.; Arms and Whitney, "The Treatment of Rooms after Diphtheria and Scarlet Fever," *Am. Jour. Pub. Health*, 1912, vol. II, no. 10, p. 799.

[2] "Disinfection of rooms after diphtheria and scarlet fever was discontinued in 1908 in this city of 235,000 inhabitants, 'living for the most part in tenements or apartments for two to six families.' It is possible, therefore, to make a comparison between the percentage of recurrences (second cases in the same family within sixty days) under the disinfection system and under the later system. For the last five years of disinfection there was a percentage of 1.48 recurrences of scarlet fever, and in the five following years, 1.53. For diphtheria the figures are 1.71 per cent during the first period and 1.75 per cent during the last. These results, Dr. Chapin believes, show that the costly and time-consuming practice of house disinfection has little or no influence on the spread of these two diseases." (*The Survey*, Nov. 28, 1914, p. 214.) Of course, these results hold good only for diphtheria and scarlet fever. It would be rash to conclude that the same thing would be true with regard to tuberculosis and other diseases of which the germs may live longer in the environment.

fumigation has been discontinued after recovered cases of diphtheria, cleansing measures being substituted.

There is also a disadvantage in the fact that terminal disinfection makes fomites infection from rooms and objects appear much more important than it actually is; also that people are confirmed in the idea that a final fumigation makes cleansing unnecessary and covers up all carelessness which may have existed in regard to bedside disinfection.

There is, then, sufficient evidence for the opinion of the Committee on Communicable Diseases of the American Public Health Association in 1912[1] "that terminal room disinfection, as at present practiced by the average board of health, has little effect in controlling the spread of infection; and that it appears, in so far as figures are available, that the percentage of return cases is practically the same in those communities where disinfection is compulsory as in those where it is not required."

So much for the usual routine fumigation. The only question now remaining is whether *really efficient* disinfection would repay, in prevention of infection, the labor and money put into it. This question is not yet conclusively answered, but there are indications which would lead one to suspect that here too the answer will be in the negative.

At present the practical health officer is justified in omitting routine terminal disinfection and insisting instead: *first*, upon careful bedside disinfection during the course of the disease; and, *second*, at the close of the isolation, upon appropriate disinfection (see Appendix A) or destruction of any specific surfaces or articles which may have become contaminated with infectious matter; the whole to be followed by sunning and airing. Of course the second set of precautions need be less extensive in proportion as proper care has been exercised during the illness.

[1] *Am. Jour. Pub. Health*, 1913, vol. III, no. 4, p. 388.

Terminal room disinfection may be of some use after tuberculosis, the germs of which are comparatively hardy and may be thickly scattered in the apartment of a careless consumptive. But in diseases like measles and scarlet fever, the virus of which is apparently very short-lived, it can be of very little, if any, use. The supposed value of such disinfection has been greatly exaggerated in the past, and even now it is not infrequently the futile and wasteful practice to fumigate whole houses, the only result of the process being the conferring of a false sense of security.

Under unusual circumstances room disinfection is of course worth performing even if the added precaution is very slight. Thus the sudden appearance of a case of smallpox in a smallpox-free city might justify extreme precautions which would not be justified as routine measures were the disease already established. As Chapin remarks, "A spark in the dry grass should be stamped out at any cost, but it is useless to waste time in extinguishing the smouldering flames left here and there as the line of fire is sweeping across the prairie."

There is also some justification for fumigation after the removal of a case to the hospital, or after death, in the height of the disease, though even here very much the same remarks apply as apply to terminal disinfection strictly so-called. Where a thorough cleansing of surfaces and objects capable of being infected through contact of discharges or hands or otherwise, and disinfection of bedding, utensils, etc., can be secured, fumigation may well be omitted in these cases also.

The whole question of terminal room disinfection is at present under advisement of a special committee of the American Public Health Association, from which a report is soon to be expected.

Isolation Hospitals. — Difficulties in home isolation have led to the establishment of municipal hospitals for com-

municable disease.[1] No community should be without such facilities. Expense need not be a deterrent, for several towns may unite in the erection and maintenance of a joint hospital, or it may be established under county authority, as has been done in some states. Automobile ambulance transportation makes it possible to make use of an institution situated, if necessary, some distance away.

There are advantages in hospital facilities both as to isolation and as to treatment.[2] If there is any question about home conditions, the case should go to the hospital. Moreover, school children in the family may then go back to school so much the sooner, and there is less chance of creating carriers in the family. Isolation hospitals will not, as Chapin points out, entirely "stamp out" disease, any more than home-isolation will, but they do have certain positive advantages.

Health authorities should be vested with the power of compulsory removal to the isolation hospital, — such power to be exercised, however, only after all means of persuasion have been exhausted and upon proper authority, e.g., certification of the health officer (or health department physician) and the attending physician or isolation hospital physician that such removal is necessary. While such cases are infrequent, the law should be adequate and should, when necessary, be firmly employed.

Public opinion should be educated on the advantages of the isolation hospital. Such an institution, built and managed according to the best modern ideas, should remove the popular dread of the old-fashioned "pest house." Isolation hospitals may, if necessary, be located in populous

[1] Wodehouse, "An Isolation Hospital Built and Operated by a City Department of Health," *Jour. Am. Pub. Health Assn.*, 1911, vol. I, no. 10, 677; Woody, "Municipal Hospitals for Contagious Diseases," *Am. Jour. Pub. Health*, 1912, vol. II, no. 9, p. 726.

[2] Chapin, *Rpt. Supt. of Health*, Providence, R. I., for 1912, p. 76; Roberts, "Quarantine or Isolation in Diphtheria," *Am. Jour. Pub. Health*, 1911, vol. I, no. 5, p. 353.

districts; there is no danger to the neighborhood from a properly conducted hospital, popular prejudice to the opinion to the contrary notwithstanding.

Care of Dead Bodies: Funeral Restrictions. — Bodies of persons dead of communicable disease are traditionally sources of infection. This was perhaps due to a false belief in air infection. From what is now known it is evident that a body enclosed in a coffin, especially when embalmed with the powerful germicides ordinarily used by embalmers (of which formalin is the usual basis), is not a source of infection. We now know that it is the living, not the dead, who spread disease. Public funerals after death from certain communicable diseases are frequently forbidden, but the only apparent benefit lies in thus discouraging the association of well persons with the carriers who may exist in the household.

We may now take up individually the diseases of the first class, bearing in mind that the preventive measures for all are in principle the same: *isolation*, *bedside disinfection of discharges*, and withal *prophylactic cleanliness.*

DIPHTHERIA

Diphtheria may be described as a specific local infection of the mucous membranes of the throat (pharyngeal diphtheria, "membranous croup") or nose (nasal diphtheria), or both, accompanied by more or less severe constitutional symptoms. The virulence varies from the mildest recognizable cases up to the most severe.

The causative organism is the *Bacillus diphtheriæ* (also known as the Klebs-Loeffler bacillus), which may be artificially cultivated on a special culture medium ("Loeffler medium") and may be identified by expert microscopic examination of the resulting culture. Some strains of diphtheria bacilli are non-virulent; in order to determine virulence animal inoculations are necessary. The absurd popular idea that diphtheria may arise from

sewer gas and other foul emanations is still frequently met with. The germ derived from a previous case or carrier is the invariably necessary cause of the disease.

Antitoxin. — A powerful remedial and prophylactic agent is fortunately available in diphtheria antitoxin, a serum containing elements which, when injected into the circulation, neutralize the toxin (poison) secreted by the diphtheria bacillus. "Antitoxin is a specific and sovereign remedy. When given in sufficient amounts during the first 24 hours of the disease it reduces the mortality to practically nil. . . . In order to obtain the full life-saving benefits of diphtheria antitoxin it should be given early in the disease. Time is the most important factor. When the damage to the cells has been done, it may be too late. It is not always advisable to wait for bacterial confirmation." (Rosenau.) In severe cases especially, antitoxin should be administered early and in one large dose; and if it be administered intravenously there is a gain of some hours in the manifestation of the beneficial results, which are therefore greater than when the same number of units are administered subcutaneously.

The antitoxin is an exceedingly valuable agent, not only for the *cure* of the patient, but also for the *immunization* of those who have been exposed to the infection ("contacts"). Just what persons in a family should receive prophylactic injections of the antitoxin is a matter for determination in the individual case, depending on the degree of exposure. Special attention is to be paid to children; adults are much less prone to develop the disease. Where there has been direct exposure, an immunizing dose of 500 units, or preferably 1000 units (Rosenau) should be given. The protective effect gradually wears off, and the dose should be renewed every 2 or 3 weeks if exposure has been repeated. "Upon the first appearance of sore throat, fever, or other suggestive symptoms in persons who are exposed to diphtheria a full dose of 3000 to 10,000

units should be administered without delay." (Rosenau.) There should be no hesitation to administer antitoxin when there is any real danger.

Contrary to what might be expected, the ordinary injection of antitoxin does not, according to Rosenau, hasten the disappearance of the bacilli; and recovery does not necessarily signify that the patient is free from infection, even though the throat symptoms have cleared up.

Transmission. — The germs are shed off in the sputum and nasal discharges of the patient, though other mucous membranes or abraded surfaces may become infected — e.g., the conjunctival or vaginal mucous membrane, or open wounds — in which case the discharges from these lesions are infectious.

Contact infection (see page 113) is the chief mode of transmission, but transmission through milk and other food supplies readily takes place. The germs thrive in milk, and many epidemics of milk-borne diphtheria are on record.

INCIDENCE. — Diphtheria is chiefly a disease of childhood, the great majority of cases occurring among infants and children of school age. It is a disease of the fall and winter months. This seems to be the effect of the season rather than of the congregation in schools. It is a fact that the heightened sensitiveness of the respiratory passages at this season, with the additional strain thrown upon them by poor ventilation, tends to make infection easier. During the summer months there is comparatively little diphtheria.

Control. — Measures under the following six heads should be adopted by health departments:

1. Provide ready facilities for free *bacteriological diagnosis* by means of diphtheria cultures. While many cases can be diagnosed positively on the clinical symptoms, there are also many of an atypical or suspicious nature in which the assistance of a cultural examination is indispensable. The examination should be made locally if a competent

bacteriologist is available, for the transmission of cultures to a distance impairs and delays the results. Such examinations are, however, frequently made for the smaller communities by state health department laboratories.

The rationale of the cultural process is simple. A sterile swab is rubbed by the physician over the mucous membranes of both nose and throat, and is then passed lightly over the surface of a special culture medium ("Loeffler medium"). The latter is then incubated at body temperature (37° C.), and the culture is examined microscopically after 12 hours or so. The diphtheria bacilli, if present, are recognized by their microscopical appearance. A practice may be made of receiving cultures up to, say, 5 P.M., for examination and report next morning.

The outfit for examinations includes a swab in a tube (two swabs if separate examinations are to be made for nose and throat), both sterilized, together with a tube of the sterile culture medium, both tubes being enclosed in a stiff envelope, tube or box, with a blank slip for filling in the name and address of case and other data. The physician, after swabbing, inoculates the medium, and returns the used, possibly infected swab to its tube. In handling such outfits after use, the danger of possible infection must be remembered and precautions taken accordingly. Swabs alone should not be received unless special provision is made for direct swab examinations, which are not recommended for routine work. Convenience may require the establishment of culture stations and collection incubators at special points.

There are considerable practical difficulties in the cultural examination; diphtheria germs originally present may be "overgrown" or "contaminated" by other forms, or may be present in very small numbers. Or it may be that they were missed entirely in the process of swabbing. Even if present, they may not be typical in appearance. Considerable skill is necessary on the part of the bacteriol-

ogist to render a definite decision, or such a decision may be impossible. The lesson to be drawn is that even under the best conditions as to culture and bacteriological skill, there is a considerable margin of uncertainty involved. *While a positive cultural result may be taken as assuring the presence of diphtheria bacilli, a negative result does not necessarily signify that the bacilli are absent.* Thus a positive clinical diagnosis should not be reversed because of the failure to obtain a positive culture. In fact, a reasonable presumption of clinical diphtheria, though opposed to a negative bacteriological finding, should be accepted. It is also clear how two cultures taken at or about the same time may turn out, one positive, the other negative; this throws no discredit on the method beyond the fact that in the latter case, for some reason, the germs were missed. What has been said applies to single negative cultures. Since, therefore, a single negative culture indicates very little, a negative decision should be based only upon at least *two consecutive negative results.* This applies particularly in connection with the release of cases from quarantine (see below).

The results of examinations should be reported to physicians by telephone, say before 10 A.M., under the following heads:

1. Positive.
2. Negative.
3. Doubtful, or suspicious (infrequent).
4. Contaminated (rare).
5. No growth (rare).

In the last three cases another specimen should be requested.

Action should at once be taken in the positive cases, but a report in regular form within the legal period should be required from the physician in order that the action of the department may thus have his sanction in writing.

2. *Furnish a high-grade antitoxin* at cost (free to indigent

cases) for prophylactic as well as for curative purposes. Reliable antitoxin tested by the U. S. Public Health Service may be obtained from commercial manufacturers and some state health departments. If kept cold it will keep its strength practically unimpaired for several months, and after its time has expired may be exchanged for fresh. Its prophylactic use has already been explained. Physicians should be notified of the provisions made for distribution, and the antitoxin should be given out to indigent cases on the written certificate of the attending physician that they are unable to pay.

Attention is called to the fact that antitoxin as ordinarily administered simply protects the individual without affecting the diphtheria bacilli with which he may be or may become infected. (Rosenau.)

3. *Isolate known cases and, so far as practicable, carriers, insisting upon proper disinfection of the infectious discharges.*

The isolation of known cases may be carried out in the usual manner, but carriers present a very difficult problem. A very considerable number of attendants on the sick and of persons in the family of the sick, and even some proportion of persons in the general population who have had no known association with the disease, harbor the diphtheria bacillus in the nose or throat, though they remain in good health. Graham-Smith (cited by Rosenau) found that 66 per cent of the members of the family to which the diseased person belonged were infected, this proportion varying from 10 to 100 per cent accordingly as isolation precautions were or were not taken. Other similar observations may be cited.[1] Slack, Arms, Wade and Blanchard [2]

[1] See Rosenau, "Preventive Medicine and Hygiene," 1913, pp. 146–148; also Ledingham and Arkwright, "The Carrier Problem in Infectious Diseases."

[2] "Diphtheria Bacillus Carriers in the Public Schools," *Jour. Am. Med. Assn.*, March 19, 1910, vol. LIV, pp. 951–954.

found that at least 1 per cent of 4500 healthy school children in Boston carried diphtheria bacilli without clinical symptoms. Moss[1] found, among school children and general population in Baltimore, 3 to 4 per cent of carriers, or 20 carriers per known case, remarking: "that this is far below the actual number is certain," for only single throat examinations were made. This certainly indicates that the diphtheria bacillus is widely distributed. It is fortunate that such bacilli have ordinarily little or no virulence.

The carriers of apparently the greatest importance — i.e., those who, while themselves immune, harbor and distribute *virulent* bacilli — are chiefly to be looked for within the association circle of the known cases. It is through them that the disease spreads, in spite of isolation, through untraced paths. Thus when 25 cases of well-recognized diphtheria occurred in two of the schools of Davenport, Iowa, during 1911–1912, bacteriological examination showed that 20 per cent of the other children of these schools were diphtheria carriers. The virulence test was positive in 90 per cent of the cases.[2]

A strictly logical plan would involve taking cultures from members of the family and others within the sphere of association of the patient, and then to isolate those who show the presence of the germs. This procedure, though it has been attempted, would of course involve many difficulties, and public sentiment, at least at the outset, would oppose it strongly. While sanitary measures should not be carried beyond the point where the restriction is more burdensome than the evil which it prevents, nevertheless the isolation — or at least surveillance — of all carriers is indicated on scientific principles as the ideal plan and the one which should be approximated as nearly as possible. Detection and isolation of carriers have proved their

[1] *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. IV, pt. 1, p. 156 ff.

[2] Albert, in paper referred to below.

value in the control of institutional epidemics and should be extended to the general population so far as possible.

However, the strict measures which might apply to a diphtheria outbreak cannot be applied to the endemic diphtheria which constantly exists in the population; in other words, we may culture the persons in association with known cases, but we cannot well culture the entire population to locate many unrecognized carriers which certainly exist. As in many other sanitary problems, where the ideal is impracticable we must compromise by doing what is feasible and, within inevitable limits, effective.

Again, there is no *ready* method of distinguishing between the carriers of virulent and non-virulent bacilli. Consequently prompt and sweeping action in regard to carriers must at the present time include many harmless carriers of non-virulent bacilli, who must be restrained at least until virulence tests of the bacilli can be made.

In regard to outbreaks in the *schools*, health officers may take a fairly definite course of action. While the rôle of the schools in the dissemination of communicable disease has undoubtedly been exaggerated in the past, still the school is a place of association of children from various homes and hence to a certain degree a danger point. It is, furthermore, the only place where numbers of children can well be medically inspected and cultured. Albert,[1] in a discussion of the carrier problem, stating that diphtheria carriers in the public schools have been successfully controlled in a number of our larger cities, recommends the following procedure:

1. *Whenever there is an outbreak of diphtheria among the children of a certain school, the throat (and in suspicious cases, also the nasal cavities) of every pupil, teacher and other person in such school*[2] *should be examined*

[1] Albert, "Diphtheria Carriers and Their Relationship to Medical Inspection of Schools," *Am. Jour. Pub. Health*, 1912, vol. II, no. 10, p. 794.

[2] This procedure might perhaps be limited to the *rooms or grades* in which cases occur. Thorough examination would require two consecutive cultures in each case. — J. S. M.

both by inspection to note the condition of the throat and by bacteriological examination.

2. *Those with a "sore" throat should be sent home immediately and should not be permitted to return to school until proved by bacteriological examination not (or no longer) to be diphtheria carriers, or in case the bacilli persist in remaining after a thorough attempt at removing them, the patient should remain isolated until it is proved that the bacilli are not virulent.*

The diphtheria carrier, rather than the premises, should be quarantined. The carrier should remain somewhat isolated from the other members of the family but such other members should be permitted to go in and out of the house to attend school or their places of business. It is advisable, however, to have the house placarded to serve as a warning or notice to have persons, not members of the family, stay out. The card may be labeled as follows:

"*Carrier of diphtheria here — keep out.*"

It is likewise advisable to place in the hands of the family a circular explaining what is meant by a diphtheria carrier and the danger of such and advising them to call a doctor to the house to treat the nose and throat in order to remove the carrier condition. In case the family prefers I believe it to be advisable to have the medical work done by the health officer, if not a practicing physician, at public expense.

The following measures may be employed to rid the nose and throat of diphtheria bacilli:

(*a*) *Local Application of Disinfectants.* — The nasal cavities and throat should be sprayed with a mild disinfectant such as a solution of hydrogen dioxide (0.5 per cent by weight of absolute hydrogen dioxide which is the solution of hydrogen dioxide of the U. S. Pharmacopœia diluted with 5 parts of water) or of some mild alkaline disinfectant as Carl Seiler's solution.

The throat will permit of more severe measures than the nose. A solution of 1 per cent by weight of absolute hydrogen dioxide may be used as a gargle or the surface may be swabbed with a 5 per cent solution of silver nitrate. Care should be taken not to have such an excess of the reagent on the applicator that it will trickle to the larynx.

The local application of such disinfectants usually succeeds in removing the carrier condition in a few days.[1] Sometimes, however, more

[1] Test cultures should of course not be taken for some time after the application of disinfectants. It should be added that the efficacy of the class of treatment here described is questioned by some authorities. Rosenau states that "careful attention to the hygiene and cleanliness of the mucous membranes may hasten their [the diphtheria germs'] disappearance, and this is favored by copious washing of the throat and nose with large volumes of physiological salt solution. Antiseptics, such as silver nitrate, applied locally, seem to be of little service." ("Preventive Medicine and Hygiene," 1913, p. 148.) — J. S. M.

drastic measures must be employed before the germs disappear. Knowing that the crypts of tonsils afforded a good hiding place for the bacteria we have tried the disinfection of such by the use of a swab dipped in a 10 per cent solution of silver nitrate and well introduced into the crypts. By so doing we succeeded in getting rid of the bacteria in 18 cases (all attempted) which remained as carriers after repeated swabbing of the surface. Squeezing the tonsils and forcing out the exudate often existing in the form of plugs from the crypts has been tried with some success by Kretschmer, who succeeded in freeing 13 patients from the carrier condition in which the more simple measures failed.

(*b*) [Describes spraying with living cultures of staphylococci. Omitted here, as this procedure does not appear to be as yet thoroughly established.]

3. *Those who have no sore throat may remain in school until* [*and unless*] *the result of the bacteriological examination indicates that they are diphtheria carriers. If such is the case they should remain at home and be treated as mentioned under* (2).

It is stated that such measures have been effective in a number of instances. The writer just quoted states that severe outbreaks in four cities in Iowa were so checked, although similar outbreaks which had occurred previously had continued for months. Instances may also be cited from Cleveland[1] and elsewhere.

It is certainly time that systematic detection of carriers took the place of the perfunctory and useless fumigation of school-rooms which is frequently considered the sole measure required for the protection of the school.

The problem of carriers demands the careful attention of health officers, for it is at present the crux of the control of diphtheria.

Outbreaks of diphtheria occur not infrequently in institutions — asylums, hospitals and the like — where it rapidly gains a foothold. The measures to be recommended in such instances are, according to Rosenau: first, a prophylactic dose of 1000 units of antitoxin to all persons in the institution; and, second, isolation of both cases and car-

[1] *Am. Jour. Pub. Health*, 1913, vol. III, no. 9, p. 976.

riers. The latter measure is the truly suppressive, for if not properly carried out the germs will persist longer than the antitoxin immunity. The latter must, however, be renewed, if necessary to keep it up, every ten days or two weeks. In the detection of carriers all persons in the institution, including both inmates and administrative force, must be examined culturally, the cultures being taken from both nose and throat, and all persons showing positive results (whether virulent bacilli or not) are to be isolated. The usual prophylactic measures are to be employed, attention being paid to towels, eating utensils, cups, glasses and other articles which may be used in common.

Terminal disinfection is apparently of little value, especially if proper care has been exercised during the course of the disease.

4. *Immunize Contacts.* — See under Antitoxin, page 137.

5. *Regulate the length of isolation by the culture method.* — No convalescent or carrier should be released until two consecutive negative cultures taken at least 24 hours apart have been obtained from nose and throat.[1] The duration of isolation under this rule will usually be ten days to three weeks, though some cases may be kept considerably longer. If the germs persist an unusual length of time virulence tests may be made, and if the culture proves non-virulent the case may be released.

6. As regards *school-children:*[2] on account of the possibility of carriers, children (other than the patient) in infected families should be excluded from school during the quarantine, and should not be re-admitted until one negative or non-virulent culture from nose and throat has been obtained from each child in the family. Such cultures

[1] Slack, " A Résumé of Diphtheria Examinations made in the Boston Board of Health Bacteriological Laboratory in 1909," *Jour. Am. Pub. Health Assn.*, 1911, vol. I, no. 11, p. 819.

[2] Cf. remarks on school outbreaks, above, p. 143 ff.

should not be taken until 48 hours after the termination of isolation, so that any bacilli present may have time to develop. It would be advisable, where this plan is adopted, to keep up the placard and maintain the quarantine on the family until all the cultures have proved negative.

As for children in non-infected families in the same house, if there has been much association such children should be excluded from school like children in the infected family. If, however, there has been little association and good quarantine exists, such children may be permitted to attend if they show negative (or non-virulent) cultures taken 48 hours after institution of the quarantine.

If the case goes to the hospital, or the well children of the family go promptly to live away from home, they may return to school if their cultures taken 48 hours afterwards are negative. Children in the other families in the house, if there has been association with the patient, may be treated likewise.

The practice in regard to these matters varies, and no absolute rules can be laid down. The above, however, represent good practice at the present time and serve to illustrate the principles involved.

SCARLET FEVER

Scarlet fever (scarlatina) is an acute febrile infection characterized by sore throat and a diffuse eruption which appears during the first day or two of the fever. After several days the inflammation in the skin, which gives the disease its name, gives way to a peeling of the superficial layer of the skin — known as desquamation. The disease varies in virulence; most of the cases now seen are mild, some scarcely recognizable except by the desquamation; and desquamating but previously unrecognized cases are not infrequently found, e.g., in medical school-inspection. Popularly it is often thought that "scarlatina" is a mild infection distinct from scarlet fever; this, of course, is in-

correct, the two terms being interchangeable. Even in mild cases serious aftereffects upon kidneys and other organs are to be guarded against through care in convalescence.

The cause of scarlet fever is as yet unknown. Streptococci are constantly found in the throats of scarlet fever cases, but the etiologic connection has not been established.

With scarlet fever, as compared with diphtheria, we are at a disadvantage, for we do not know the causative organism, are unable to trace the paths of transmission, and have no specific antitoxin as a preventive and curative agent.

Transmission. — The chief source of infection in scarlet fever, so far as known, is the secretions of the mucous membranes of the nose, throat and respiratory tract. The infection enters the body by the same routes. According to the best opinion to-day the desquamation (scales) plays little or no part in infection, especially in the latter stages. Hence desquamating patients may safely be released provided sufficient time has elapsed and the condition of the mucous membranes is normal. On the other hand, patients who have finished desquamating may still spread infection through abnormal discharges from throat, respiratory passages, nose, or ear, or other sequelæ. Such facts are established by a study of the "return cases" occurring in a family after the return of patients discharged from the hospital.

Since the cause of scarlet fever is unknown there is no way of determining just when each patient ceases to be infective.

Scarlet fever is about as communicable as diphtheria, i.e., less so than measles and smallpox.

Carriers and mild and unrecognized cases are unquestionably frequent, and play a great part in disseminating the disease.

Scarlet fever is transmitted chiefly by contact in just the same way, so far as known, as diphtheria. Foods may

also convey the infection; many milk-borne epidemics are on record.

INCIDENCE. — Scarlet fever, like diphtheria, is a childhood disease, the great majority of cases occurring under fifteen years of age. Its seasonal incidence resembles that of diphtheria, the majority of cases occurring during the winter months. During the summer season it usually drops to a very low point.

Control. — Known cases should be isolated and discharges from nose and mouth disinfected, and efforts should be made to detect mild and atypical cases in the zone of association of the patient. Medical school inspection helps in locating such cases. Parents should be educated to be watchful for early symptoms in their children.

Streptococcus vaccines have been used with apparently favorable results in immunizing persons against scarlet fever, but have not yet been tried out in this country.[1]

Terminal disinfection is apparently of little or no value, especially if proper bedside disinfection has been carried out.

The period of isolation varies with different authorities. Very long periods are excessive and are a burden on the family, without apparent commensurate benefit to the community. No patient should, however, be released if inflammation of the throat or discharge from nose, ear or abscess persists, for the secretions in such instances may remain long infective. *Cases may be released when abnormal discharges have ceased and the patient appears normal (even if desquamation is incomplete); a minimum period of four weeks* should, however, be maintained. This practice has been proved safe by experience in towns and hospitals.[2]

[1] Rosenau, "Preventive Medicine and Hygiene," 1913, p. 164.

[2] Rpt. Committee on Communicable Diseases, Am. Pub. Health Assn., *Am. Jour. Pub. Health*, 1913, vol. III, no. 4, p. 387.

Cf. the following: — "In England, where more work of this kind seems to have been done, it has been found that, by discharging patients when the throat and nose appear normal without regard to desquama-

As to school-children: since there may be carriers in the zone of association of the case, it may be safest to exclude all children in the house (including those in non-infected families) during the period of quarantine. If, however, the quarantine is good, it is proper to permit children in the non-infected families to return to school one week after the quarantine has been instituted. (This allows time for development of the disease if they have been infected; if they have previously had the disease they may return at once.) Medical inspection of schools is an additional safeguard in such cases. Children in the infected family should be excluded until the expiration of one week after the termination of isolation.

If, however, the case goes to the isolation hospital or the well children leave home, they may, if free from symptoms, return to school one week later.

MEASLES

Measles (morbilli) is an acute febrile disease characterized by skin eruption and inflammation of the mucous membranes of the eyes, nose and respiratory passages. In itself it is usually not severe, but its complications and aftereffects (e.g., especially pneumonia) are to be feared. The fatality is greatest in infants and young children.

tion, the average stay in hospital was reduced from 45 to 29+ days without any increase in the percentage of return cases. . . . Observations in this country seem to show that patients with a nasal discharge but free from desquamation invariably cause return cases soon after release, while patients who are desquamating but free from nasal discharge do not so cause return cases." (Previous report of above Committee, *Am. Jour. Pub. Health*, 1912, vol. II, no. 2, p. 122.) Sometimes the discharged patient develops a recurrence in the form of a " cold " and this is followed by a return case. The Committee recommends further study of the subject of return cases, as to whether the discharged patient had desquamation or nasal discharge or both, and as to whether the patient developed a " cold " shortly before the onset of the return case.

The importance of measles as a cause of death is shown in Chart 2, where it ranks with scarlet fever.[1] This fact is not generally recognized. Many measles deaths are inaccurately assigned by physicians to terminal conditions of pneumonia, etc., and are so classified.

The cause is unknown.

Transmission. — Measles is one of the most highly communicable diseases known, ranking with smallpox. This has led many observers to believe that the virus is air-borne. This may be so in some instances, but contact (including droplets) infection from the secretions of the nose, throat, and respiratory passages is probably responsible for the great majority of cases.

Contrary to former belief, modern evidence indicates a strong probability, if not altogether a certainty, that the desquamation is not a medium of infection.

Measles is readily transmissible by contact and man is susceptible to even minute amounts of the infection, but the virus dies out quickly in the environment. Rosenau states that after two weeks following termination of isolation there is practically no danger of contracting the disease from the room in which the patient has been treated, even without disinfection. Fomites infection would therefore be rare.

The incubation period is long (9 to 11 days, possibly 14), and the disease is contagious for several days before definite symptoms; it may also possibly remain contagious in convalescence.[2]

Incidence. — Measles is a disease of infancy and childhood; over half the fatal cases occur in infants under two years, and over 80 per cent under five years. When it occurs in later adolescence and adulthood, the fatality is very much less.

[1] A detailed statistical study of measles has been made by Crum, *Am. Jour. Pub. Health*, 1914, vol. IV, no. 4, p. 289.

[2] See, however, note on next page.

Control. — There are two great obstacles to the control of measles: its extreme contagiousness and the fact that it is contagious for some time before it can be positively recognized.[1] The prodromal symptoms are those of an ordinary coryza or cold in the head, — symptoms so common among children as ordinarily to give rise to no suspicion. Most of the harm is done before the diagnosis is made, and in many cases no physician is called at all. There may also be carriers and unrecognized cases, but probably less frequently than in scarlet fever, diphtheria and typhoid fever.

For the reasons above set forth, the ordinary measures of isolation, etc., can accomplish but little. Nevertheless it is worth while to do what is feasible to prevent infection from known cases. Even if but a comparatively small number of cases and deaths are saved, the measures are justified. Health authorities should therefore:

1. *Require reporting* of cases, and *quarantine* them in a modified manner for 15 days from onset and until all symptoms have disappeared.[2] The mildness of convalescence and popular indifference toward the disease make a strict isolation in most cases impracticable; but the patient should be required to remain on the premises, and a placard should be used to warn children from entering. Other children in the family are almost certain to take the disease unless strictly separated. Terminal disinfection is of practically no value.

Children in the infected family should be excluded from

[1] The difficulties are well illustrated in an outbreak which occurred in Chicago (Young, *Am. Jour. Pub. Health*, 1912, vol. II, no. 10, p. 791).

[2] Experiments (Anderson and Goldberger, U. S. Pub. Health Service) on monkeys show an apparent period of infectivity of only three days — 24 hours before and 48 hours after the appearance of the eruption. The minimum 15-day quarantine, however, tends to insure proper convalescence, and errs, if at all, on the safe side.

school for 15 days[1] unless they can show medical certificates that they have had measles. It is difficult to keep measles from spreading to other children in the family. Such children, if they have not already had the disease and have not been exposed, may be sent away from home, but the possibility of still further spreading the disease in case they may have been exposed must be considered. Children in other families in the house need not be excluded unless they have been exposed.

2. Endeavor to obtain *early recognition and medical treatment* of cases. Parents should learn to treat all "colds" in children as suspicious, to keep such children separate from others, and to guard against contact infection until the nature of the "cold" is ascertained. Infection, by the suspect, of towels, handerchiefs, toys, eating utensils and other articles used in common among children should be avoided. Such home prophylaxis is also of much value as a protection against the other communicable diseases which frequently start with symptoms of a feverish cold or a sore throat. Publicity on such subjects is desirable. When parents take such matters more seriously a corresponding advance in prevention will result.

3. Call attention of physicians and of parents of cases to the need of *care in convalescence* in order to avoid serious aftereffects. In this way the fatality rate may be reduced. The same precaution applies to whooping cough, light cases of scarlet fever and other mild diseases from which the chief danger is to be apprehended in the incidental effects upon heart, lungs, kindeys and other vital organs.

[1] Since the incubation period is long, it has been suggested that such children be allowed to continue at school for 8 or 10 days after exposure, then be excluded for a week to ten days, after which those who do not develop the disease may be allowed to return. This plan, according to Rosenau, is followed in certain districts in England. It assumes, however, that the time and period of exposure are definitely known for each child, which is not always the case; and in any case safe leeway should be allowed.

GERMAN MEASLES

German measles (rubeola, rubella, rötheln) resembles measles in symptoms and transmission, but is a distinct disease and of less importance. It is chiefly of interest in relation to the schools. It may be made subject to similar measures, with a minimum quarantine of 10 days.

WHOOPING COUGH

Whooping cough (pertussis) is an infection caused by the bacillus discovered by Bordet and Gengou. It is of much greater importance as a cause of mortality among infants and young children than is popularly supposed; the mortality ranks with that of scarlet fever (Chart II, page 76), and is due largely to the pulmonary complications, chiefly pneumonia. Doubtless a considerable number of the deaths are put down to the latter instead of to the primary cause.

Transmission. — The virus exists chiefly in the expectoration, but all secretions from nose and mouth are to be guarded against. Whooping cough is communicable from the earliest symptoms, during convalescence, and even after the subsidence of the characteristic cough, being most infectious during the early stages. Transmission is chiefly by contact. Domestic animals (dogs and cats) may become infected and transmit infection. Mild, unrecognized cases play a part in its extension.

Incidence. — The great majority (95 per cent) of the fatal cases occur under five years of age, and over half in infants under one year.

Control. — Most of the remarks made under the head of measles apply in substance here. The obstacles to control are: that the disease is communicable before it is recognized; that the infective convalescent period is long, lasting possibly eight weeks; that the mildness of convalescence makes quarantine measures irksome and difficult

to enforce; and that parents regard the disease merely as an inevitable and harmless incident of childhood. As in measles, however, health authorities should take what precautions are feasible, even if these are by no means ideal. Such are:

1. To require *reporting* of cases.

2. To institute a *modified quarantine*, as in measles. During the long period of convalescence the patient should be allowed a certain degree of freedom, provided he does not come in contact with other children or handle articles which may be handled or eaten by them. Fresh air is a helpful curative agent, and the patient may be allowed airings under adult care. It has been proposed that such patients be allowed freedom with the requirement that they wear some warning mark, such as a green or yellow arm-band. Infection of infants and old persons should be especially avoided on account of the possible serious consequences. Either such persons or the patient may to advantage be sent away from home. The restrictions should be kept up until all symptoms have disappeared — preferably several days longer; some authorities recommend a period of even eight weeks.

Terminal disinfection is of no practical value.

Well children in the family need not be excluded from school unless they have a suspicious cough.

3. To *inform parents* as to the seriousness of the disease and the importance of *early prophylaxis* in case of suspicious symptoms in children (see measles). Many cases are not considered serious enough to call a doctor.

A vaccine (pertussin) may be used for both curative and prophylactic purposes, but its use is not yet established.[1]

LOBAR PNEUMONIA

Pneumonia, an infection by the *Pneumococcus*, rivals and sometimes exceeds tuberculosis as the chief of all

[1] *Am. Jour. Pub. Health*, 1913, vol. III, no. 8, p. 839.

causes of death. Like tuberculosis it may be regarded as an infectious and communicable disease of which the germs are extensively distributed but which depends for its propagation upon lowered vital resistance of individuals rather than upon facilities for infection. Epidemics of pneumonia have, however, been noted, and in a sense it may be regarded as a constantly pandemic disease to which we have become accustomed.

Transmission. — The pneumococcus may frequently be found in the mouths of healthy persons, who are not affected by it until some depression of vital resistance permits invasion by the germ. Even robust persons may succumb if their vital resistance is greatly depressed. On the other hand, each case should be regarded as a focus of fresh infection which may be communicated by the various ways of contact infection. It is possible that in many of these cases the germs are of a heightened virulence. It is also possible that there are unrecognized carriers of especially virulent pneumococci. Lack of proper ventilation, dusty atmospheres, exposure, intemperance and neglected colds are among the predisposing factors.

INCIDENCE. — The mortality from pneumonia is distributed over all ages. Nearly one-fifth of the fatal cases occur under two years of age, nearly one-third over sixty and the remainder over the prime of life. It is one of the chief factors in infant mortality, and, since it may be almost entirely prevented by proper infant hygiene, we must to that extent at least place pneumonia among the diseases controllable through public hygiene.

Control. — The principles of prevention are: first and chiefly, keeping up the vital resistance of individuals; and, second, limiting so far as practicable the spread of the pneumococcus. The first of these lies largely within the control of the individual and is to that extent a matter of personal hygiene. The health authorities may, however, combat pneumonia in the following ways:

1. *By improving housing and factory conditions*, especially as regards ventilation.

2. *By popular education* on personal hygiene — e.g., the value of fresh air, avoidance of "contact" infection, etc.

3. *By infant hygiene work.*

4. *By advising prophylaxis* in the individual case. Precautions similar to those for tuberculosis should be taken — i.e., proper care of the sputum. Such measures are in the hands of the physician, nurse and family.

CEREBROSPINAL FEVER

This disease, which may also be called "epidemic cerebrospinal meningitis," is an infection by the *Meningococcus*, an organism which attacks the meninges (membranes) of the brain and spinal cord. It is only one of the infections known by the loose general term "meningitis," and should not be confused with others. In order to avoid confusion the above two exact terms and no others should be used (preferably "cerebrospinal fever").[1]

Transmission. — Cerebrospinal fever occurs sporadically (single cases) and epidemically (groups of cases). It occurs, like other diseases in which the infection probably takes place through the respiratory system, especially in the fall and winter months.

It is supposed that the infective organism, the meningococcus, enters the system through the mucous membrane of the nasopharynx, and that the infection is spread through "contact" transference of the discharges and secretions from mouth and nose.

Incidence. — Children and young adults are most susceptible.

Control. — Cerebrospinal fever offers great resistance to control on account of the large number of its carriers. One authority (Flügge) estimates that healthy carriers of the

[1] See discussion of undesirable terms in the International List of Causes of Death.

disease are ten times as numerous as recognized cases. It is believed that these carriers are the principal agents in the spread of the disease, and that the germ passes rather directly from one person to another, developing only in a comparatively small number of susceptible persons. On the other hand, when the disease is prevalent it may become very severe; thus in New York in 1904–1905 there were 6755 reported cases and 3455 deaths.

As to control,[1] the large number of carriers greatly lessens the value of isolation of known cases, while the bacteriological detection of all carriers and their control is, under ordinary circumstances, impracticable. Nevertheless, until more exact knowledge of the disease is obtained, health authorities should require reporting of cases and suspected cases, isolation until bacteriological disappearance of the meningococcus, and disinfection of the sputum and nose discharges. By these measures some secondary cases and fresh carriers may be prevented, especially if prompt steps are taken with the first cases reported.

Chronic carriers should be kept under restrictive control, should be given careful instructions for avoiding spreading the disease to others through their secretions, and should receive vaccine treatment (see below).

Health authorities should provide facilities for bacteriological diagnosis (by examination of the spinal fluid) of cases and carriers. They should also be prepared to supply antimeningitis serum (a curative though not a preventive). Immunization may be effected through inoculation with a vaccine of killed meningococci. Chronic carriers should also be treated with the vaccine.

TUBERCULOSIS

Tuberculosis is the chief disease with which health authorities have to deal. In 1911, in the Registration Area of

[1] Cf. Von Ezdorf, "Epidemic Cerebrospinal Meningitis: Information Relative to Prevention of Spread of the Disease and Management of Cases," *U. S. Pub. Health Rpts.*, May 9, 1913.

the United States, it caused 11.2 per cent of all deaths. The disease has its roots deep in a complex of social and sanitary conditions which makes it also the most refractory of public health problems.

The tubercle bacillus exists in several different types, the most important of which is the *human type.* The *bovine type* may also infect man through the medium of milk. The bacillus may invade any part of the body: hence the various forms of tuberculosis — tuberculosis of the lungs, tuberculous meningitis, abdominal tuberculosis, generalized tuberculosis, etc. Tuberculosis of the lungs (synonyms: pulmonary tuberculosis, consumption, phthisis) is the commonest form; it caused 83 per cent of all deaths from tuberculosis in the U. S. Registration Area in 1911.

The question as to the severity of the disease depends not only upon the virulence of the organism in any particular case, but also very largely upon the vital resistance of the person. The infection is very widely spread, and many persons undoubtedly harbor the bacillus without perceptible bad effects and practically without being sources of infection to others. This fact, which is demonstrated by post-mortem findings of old healed lesions, is expressed in the saying current among German bacteriologists, "Everyone is a little tuberculous." The question of combating tuberculosis is therefore largely — though by no means entirely — a matter of keeping up the vital resistance of individuals, both the well and the openly tuberculous.

In short, *the development of the infection depends upon two contrary factors:* the *amount of infection* (i.e., the number of bacilli, which perhaps also vary in *virulence*), and the *vital resistance* opposed to it by the system of the person. The balance between these two factors determines how far the pathological processes shall go. Hence there are all degrees of infection, from that which is unrecognizable in its mildness to the most rapid "galloping consumption." Hence, too, there may be accelerations, retardations, arrests

and recoveries in the course of the disease. Thus, while tuberculosis is communicable, its development depends largely upon the state in which it finds the individual.

Transmission. — The bacillus is shed off, in pulmonary tuberculosis, in the sputum raised by coughing. It is most often spread by the various kinds of *contact infection* (page 113). Transmission through infected food (and perhaps water) is also possible. It is believed that "house infection" may take place, — i.e., well persons may apparently contract the disease from apartments previously infected by a consumptive; but this probably occurs less frequently than is commonly supposed, for in many such cases the possibility of direct infection from a case is not excluded. While the rôle of dust in conveying tubercle bacilli is still in dispute, it would appear that this mode of infection, relatively to more direct modes, has been exaggerated. Nevertheless promiscuous spitting should be forbidden, and dust should be suppressed if for no other reason than that sharp, irritating dust particles render the mucous membrane of the respiratory passages susceptible to the infection. It is because of the latter reason that certain dusty trades strongly predispose to tuberculosis.

Infection may take place either by inhalation or by ingestion, — i.e., either through the respiratory system or through the alimentary system. The question which of these modes is the more common is still in controversy. In the case of contact infection it is evident that the infection might take place in either manner.

Tuberculosis may also be contracted through ingestion of *milk* and milk products from tuberculous cows. In this case it is the bovine type of bacillus which is transmitted. The danger from this source is largely restricted to children. English and German commissions and certain American authorities (notably Park and Krumwiede of the New York City Department of Health) have studied the matter extensively; as the result of such studies it may be

stated that "perhaps 7 per cent of the tuberculosis in man is of bovine origin." [1] The great bulk of this consists of generalized, abdominal and glandular tuberculosis among children, scarcely any being of the pulmonary form. Such findings are the basis for legislation requiring the tuberculin testing of dairy herds and the pasteurization of milk (see Chapter III).

Incidence. — Tuberculosis falls with especial severity upon persons in the prime of life, about one-half of the deaths occurring among persons 20 to 40 years of age.

In considering tuberculosis death statistics it must be remembered that some such deaths may be returned as due to other causes. There may be mistaken diagnosis, or the physician in doubt may, on account of popular prejudice against tuberculosis, sign the certificate with some other cause.

A striking feature of the tuberculosis problem is that it is intimately connected with the vital resistance of individuals as affected by many conditions. Thus it goes hand in hand with poverty, poor nutrition, overwork, worry and intemperance of all kinds, — in short, with any condition which impairs health. Syphilis, typhoid fever and other diseases predispose to it.[2] Exposure, followed by pneumonia or even a neglected cold, may be the introduction to incipient tuberculosis. Overcrowding is a favoring condition, by reason, not only of the greater chances of infection, but also of the physically depressing conditions accompanying it. It is observed that a large proportion of the cases and deaths occur in a relatively small proportion of the houses in a community. Poor housing, with deficient light and ventilation, is a contributory factor. Of special importance are the conditions in factories: poor ventilation, irritating dusts and vapors, promiscuous spitting, excessive length or severity of labor, and the like. While

[1] Rosenau, "Preventive Medicine and Hygiene," 1913, p. 124.

[2] See p. 78, regarding typhoid fever followed by tuberculosis.

certain of these conditions can be dealt with by the health authorities, many are in the control of the public itself and can only be attacked by educational efforts. No other disease is so firmly entrenched in fundamental social conditions.

Depression of vital resistance caused by any of such conditions may permit development of the latent infection which apparently exists in almost all persons.[1]

City life, with its congestion and attendant insanitary conditions favors tuberculosis;[2] but the disease prevails also in rural districts to a greater extent than commonly supposed, being favored there by under-nutrition, overwork, lack of ventilation in farm houses, etc.

The various races show different degrees of incidence, owing doubtless to their modes of life as well as to differences in racial susceptibility. Thus the negroes show an especially high death rate (405 as compared with 126 for whites, under condensed title "tuberculosis of lungs," Registration Area, 1911). Males show a markedly higher rate than females, doubtless because of more unfavorable conditions of labor and more numerous occasions of infection.

CONTROL

As already implied, prophylaxis consists (1) in avoiding infection, and (2) in maintaining or increasing vital resistance.

Avoidance of infection is only relative, for the tubercle bacillus is so widespread that few persons or none can avoid a certain minimum amount of infection. Nevertheless, this amount should be so far as possible reduced and all occasions of gross and obvious infection, as from direct exposure to sputum from careless consumptives, should be absolutely avoided.

[1] See note, p. 163.

[2] Brewer, "City Life in Relation to Tuberculosis," *Am. Jour. Pub. Health*, 1913, vol. III, no. 9, p. 163.

Vital resistance may be increased both through personal hygiene and through sanitation of the environment, as outlined below.

Tuberculosis is not hereditary (as was formerly thought), and is seldom acquired congenitally. The fact that it tends to run in families may be explained by inherited predisposition, or by increased chances of infection from other members of the family, or both. Even with such a predisposition, however, if good conditions are maintained the individual may ward off the disease.

There is no specific serum or other remedy for tuberculosis. The natural cure consists in building up the vital resistance of the patient to throw off the infection, through a well-regulated regimen of good food, rest, fresh air, cheerful surroundings, etc., — a logical extension of the methods of proper living which play the chief part in prevention. Treatments with tuberculin (an emulsion of killed bacilli) are of use only when carefully administered in conjunction with the natural cure. Tuberculin is, however, of some value in diagnosis (in the von Pirquet cutaneous reaction, or "skin test," etc.).[1]

From what has been said it is plain that *administrative measures* must be of two kinds:

(1) *Restriction of the spread of the tubercle bacillus.*

(2) *Promotion of the vital resistance of individuals.*

The first of these requires cognizance of recognized cases of tuberculosis and measures to prevent the spreading of the germ by such cases. Although many unrecognized cases will escape such supervision, and some recognized cases will disregard the rules imposed, nevertheless these measures will greatly diminish the chances of infection.

[1] Tuberculin diagnosis has a striking result in showing that almost all persons beyond infancy have at least a latent tuberculosis infection. Thus recent authorities (Hamman and Wolman, "Tuberculin in Diagnosis and Treatment," 1912) state that while the test is of considerable value under one year of age, it is of less value from one to two years, of little value in childhood, and none in adulthood.

Experience shows that the normal human system is capable of resisting small doses of infection when it would succumb to a heavier dose, and it is just these heavier doses which supervision over the germ-shedding patient prevents. This first class of measures also includes prevention of the spread of the bovine tubercle bacillus through milk.

The second class of measures — promotion of vital resistance — is one which is largely in the hands of individuals themselves, for many of the conditions predisposing to tuberculosis are capable of control only through proper habits on the part of the person. But at the same time there are environmental conditions, in factories, tenements, schools, etc., which can and should be remedied only by the public authorities.

Bearing in mind the above objects we may pass on to a consideration of the means for attaining them.

1. **Registration of Cases.** — It is essential that the local health department have a complete record of all known cases of tuberculosis in any of its manifestations. By far the greatest number of these will, as already indicated, be of pulmonary tuberculosis (consumption). Reports should be made by physicians on a special blank. Tuberculosis records should be kept separate from those of the other communicable diseases. Most laws prescribe that tuberculosis records be kept, except as administration requires otherwise, private, — a concession to the false reproach traditionally attached to the disease. A serial book record in which reports are briefly entered and numbered in the order of their receipt, and a card catalog of histories arranged alphabetically by name of patient, constitute (as for other communicable diseases) a convenient recording system. In the catalog it will be found best to subdivide the index into "current cases, nurse's visits required," "current cases, nurse's visits unnecessary," "school children" (special classes), "cases gone to hospital or sanatorium" (each institution separately), "left town,"

"lost trace of," "suspected cases," "died," or the like; and shift the cards as occasion may require from one class to another.

It is desirable also to keep an index and spot map of houses in which cases exist; in this way foci of infection are seen at a glance.

On account of the difficulties of keeping track of tuberculosis cases the following *classes of reports* should be required, the responsibility in each instance being clearly defined.

As to *new cases:*

(*a*) Reports from physicians;

(*b*) Reports from institutions and organizations under whose notice cases may come;

(*c*) Reports from keepers and proprietors of lodging-houses and hotels.

As to *cases already known*, reports of removal:

(*a*) Report from physician when a case moves away or passes from his professional care;[1]

(*b*) Similar reports from institutions and organizations;

(*c*) Report from owner, lessee, tenant, or occupant of

[1] The only way in which this provision can be effectively carried out is by checking up the location of all cases by periodic inquiry of the physician, at least for those cases which are not visited frequently by the nurse. Note the following resolution of the New York City Department of Health, 1910:

"It is hereby ordered that every physician having a case of pulmonary tuberculosis under his care be required to notify the Department of Health once a month, on cards furnished for that purpose, if patient still resides at original address given; if not, of any change of address of such patient, in order that the premises vacated may be properly disinfected by the Department.

"And further ordered that every physician be required to notify the Department of Health in the same manner whenever a case of pulmonary tuberculosis passes from his professional care, or fails to observe the necessary sanitary precautions, in order that the Department may assume surveillance of such a case."

any dwelling or apartment, stating the removal of any tuberculosis patient therefrom.[1]

There is an unfortunate tendency with some physicians to slight the reporting of tuberculosis, owing perhaps to the impression that no special action is taken by the health authorities. Unfortunately, too, that impression is sometimes correct. But where active measures are taken and the importance of reports is impressed on physicians, their coöperation is readily enlisted. Prompt reports (within 48 hours or less) should be required. Physicians should be kept well supplied with the necessary blank forms. Where reporting is good a considerable number of duplicate cases will be reported — i.e., the same case will be reported two or three or more times by different physicians, hospitals or dispensaries. Patients tend to go from one physician to another, hence such duplicate reports should invariably be required. The data so obtained should be entered in the file on account of the confirmatory history and the record of the movements of the patient which they furnish. As to hospitals, dispensaries and other institutions, it is best that the physician making the diagnosis of tuberculosis should be specifically required to make report over his own signature, thus relieving the institution authorities of responsibility. With cases admitted without diagnosis — which is left to the interne — such a provision is especially appropriate. In any case it is strictly the physician, not the institution, which makes or confirms diagnosis.

It sometimes happens that a case is reported only a few hours before death. Such cases should be investigated in order to determine whether a diagnosis had not previously been made by the physician and the report neglected. In

[1] To carry out this provision, the person responsible for each dwelling or apartment should be notified of the existence of the case, so that such person may be held strictly accountable for notifying the health department when the patient moves (plan recently adopted in Montclair, N. J.).

some cases it may be found that the physician in question was called in only a few hours before death; under such circumstances an effort should be made to determine whether diagnosis had not previously been made by some other physician who had failed to report. It is by such following-up that the most important instances of failure to report are discovered.

All *deaths* from tuberculosis should be checked over to ascertain if the cases have been reported, and when reports have not been filed the matter should be taken up with the physician who signed the death certificate. It has been estimated that for every death from tuberculosis there are about *three* living dangerously infective cases; but there should be a greater number of cases on record, for some cases reported do not show a positive sputum and cannot therefore be classed as openly infective.[1] These latter cases may, however, be partly balanced by dangerous cases not under medical care. Of course the total actual number of cases in a community, including persons in some material degree infected but not dangerous and not under medical care, is considerably greater than reported numbers. Deficiencies in reporting should be dealt with as strictly as in any other communicable disease. Health officers should endeavor to win the full coöperation of the medical profession by indicating the high importance of this class of reports; but persistence in failure to obey the law after warning has been given should be dealt with by prosecution. In a small city known to the writer the annual number of reported cases of tuberculosis was increased, through the activity of the health officer, from 41 to 116 in two consecutive years (the number of deaths showing no increase). Where the number of reported cases is less than the number of deaths in the same year, deficiency in reporting is to be suspected.

[1] Bishop, "Tuberculosis, A Public Health Problem," *Am. Jour. Pub. Health*, 1913, vol. III, no. 4, p. 329.

Bacteriological Diagnosis. — Official facilities for bacteriological diagnosis should be provided. While many cases are readily diagnosed clinically and should be reported without awaiting bacteriological examination, the latter is indispensable in at all doubtful cases. It consists in staining and microscopic examination of the sputum (or other discharge) for the presence of the tubercle bacillus. If the bacillus is present in considerable numbers, in the specimen, it may readily be positively recognized by the regular technique. A single negative result should not, however, be given too great weight, for it is possible (as was remarked in connection with diphtheria) that the bacilli may be few and escape observation, or that the sample is not a representative one. Therefore two or more negative results must be obtained before the absence of the tubercle bacillus can be asserted with reasonable certainty. Suspected persons should be examined at intervals of several weeks. In collecting specimens for examination for pulmonary tuberculosis, care should be taken that the true sputum — i.e., the material coughed up from the lungs and lower respiratory passages — is obtained. In special cases, when it is difficult to obtain a specimen through coughing, laryngeal swabbing may be resorted to and a smear made for examination. Regular outfits for collecting specimens, together with a blank form for name of patient and other data, should be provided. Many health departments not having bacteriological facilities for this purpose arrange that physicians transmit samples to the state laboratory for examination.

2. **Home Supervision.** — Once a case has been reported to the health authorities, it becomes their duty to take steps to prevent further infection from the patient. Some laws make the physician also responsible to a certain extent for instruction of the patient in preventive measures; but, on the whole, the responsibility rests upon the health authorities themselves. Since the dangerous cases are the

"open cases" of pulmonary tuberculosis (other forms not usually being actively infectious), the precautionary measures to be taken relate very largely to the proper care of the infectious *sputum.* The guarding against contact with the patient of other members of the family, and the forbidding of the patient to engage in preparation of food for public distribution, constitute a second class of precautions. At the present time, and doubtless for a long time to come, the majority of patients — especially those in the less advanced stages — will have to be left in their natural environment — the home; and measures will have to be largely concentrated there. And since strict isolation is nearly always impracticable as well as unnecessary (patients requiring stringent control being sent to a hospital or sanatorium), such measures will have to consist chiefly in supervision through instruction.

THE TUBERCULOSIS NURSE.—Under such circumstances the health authorities work largely through the public health nurse, whose functions have already been roughly described in the first part of this book. The tuberculosis nurse performs duties which in this case go far beyond those of the ordinary sanitary inspector. She instructs the patient as to the nature of his disease, especially with reference to the danger of its spread to others. She sees, above all, that scrupulous care is observed in the disposal of sputum, — the rule simply being that all sputum and discharges from mouth and nose of the patient are destroyed. For this purpose it is convenient to use pieces of cloth which may be burned, or, better, the sputum cups or receptacles specially manufactured for that purpose. (The health department should provide such receptacles liberally and free of cost to patients; they may be purchased wholesale at low prices.) The precautions with regard to sputum apply to the patient when abroad in the streets as well as at home, a pocket sputum cup being used. The patient must further be instructed in the cleanliness

to be exercised in keeping the hands free from infection, avoiding contact infection in the family, and avoiding contaminating objects which may be used by other persons.

While there is practically no danger in living with a careful consumptive, there is a great deal of danger with a careless one. The danger in personal association is always very great unless strict precautions are taken. Working in the same room or eating at the same table demand such precautions; sleeping in the same bed occasions a serious risk. A tuberculous member of the family preparing food for other members will infect the food unless extraordinary precautions be taken, and such precautions cannot commonly be expected. The board of health of Montclair, N. J., has recently passed a resolution to the effect that children under sixteen years of age will not be allowed to live in a house where there is a case of tuberculosis unless extreme precautions are taken to prevent the spread of infection.

Tuberculosis patients who are active sources of infection should be forbidden to engage in the preparation, for public distribution, of kinds of *food* liable to infection; they should not act as cooks, bakers, confectioners, and the like, whose products pass directly to the consumer and are consumed without further cooking.

The nurse has a further duty to perform in giving the patient general advice, subject to the orders of the attending physician, as to the course of life he should adopt for his own benefit. She may recommend a certain diet, help arrange for outdoor sleeping facilities, and the like. Indirectly, whatever aids in the cure of the case tends to the prevention of other cases. She should not, however, perform actual nursing service except of a minor sort; where such is needed the district visiting nurse should be called in. The function of the tuberculosis nurse is to gain the confidence of the patient, instruct and counsel, and see that her instructions are carried out.

The tuberculosis nurse may also perform a certain amount of incidental sanitary inspection, and can discover incipient, untreated, or unreported cases.

In the selection of cases for visiting, a certain discretion, which depends partly upon the opinion of the attending physician and partly upon the circumstances of the case as judged by the health authorities, must be observed. Thus there will be a certain number of cases, under the care of private physicians — some perhaps in well-to-do families — in which satisfactory precautions are observed and which it is a waste of time as well as an intrusion to visit. The cases requiring most attention are those marked by ignorance, carelessness, or wilful disregard of sanitary precautions. There is a certain proportion of such cases in every community. Some such patients are even vagrants, having no fixed abode and moving uncertainly about from day to day, being walking and (by most persons) unrecognized distributors of infection. These patients escape from the surveillance of the health authorities only to reappear from time to time at new points. They have the restlessness characteristic of some stages of the disease combined with lack of any feeling of responsibility. They have no physicians, no fixed associations, and constitute a sore problem of the health officer and tuberculosis nurse. Of such cases and others of the more dangerous class we shall speak later under the head of institutional care.

The following, in some detail, are the *duties of the tuberculosis nurse.*[1]

Each nurse should be on duty at least six hours daily, exclusive of one hour for lunch (Saturdays, three hours daily). The health department badge is worn when on duty.

A series of forms, more or less according to local needs, are used for taking histories (for filing as already explained), for authorizing free sputum cups, for recommending cleansing, renovations, etc.

[1] Adapted (as also the ensuing section) from Monograph no. 1 of the N. Y. City Dept. of Health, Feb., 1912. Details may of course be altered, added, or omitted to suit local conditions.

Each morning a list is made of cases, new and old, to be visited, and these are cleared up if possible during the day.

The nurse coöperates with the health department physician or the health officer in investigating and recommending forcible removal of patients. In all such cases persuasion is first used in order, if possible, to obtain the patient's consent.

Suspected cases and complaints (coming usually from charitable organizations) may be tactfully investigated by the nurse, who tries to persuade the person to go to the clinic or at least she endeavors to obtain a specimen of sputum. If the result of the latter is negative and the person declines to go to the clinic, the health department physician may be requested to make an examination.

When on duty the nurse carries with her:

- Clinical thermometer;
- Watch with second hand;
- Fountain pen;
- History cards (for new cases found in district);
- Cards for referring patients to clinic;
- Circulars of information for consumptives and their families, and sweeping and dusting leaflets, in the language spoken in her district;
- Sputum bags and paper napkins;
- Placards;
- Fumigation cards;
- Sputum bottles, for obtaining specimens of sputum.

The first duty of the tuberculosis nurse is to exercise the necessary sanitary supervision over the cases of pulmonary tuberculosis living in her district. Almost the first question asked, when making a visit on a new case, is whether the patient is under the continued care of a private physician; if so, his name and address are obtained. In tracing cases on first visit or, if unable to obtain admission, when making a revisit, no messages are left with neighbors. The reason for the nurse's visit (i.e., that there is a consumptive on the premises) is only to be given to the family. The nurse furnishes the department of health with prompt, accurate and sufficiently frequent reports as to where the patient is, his general condition, whether the necessary precautions are being observed (sputum, etc.), if he is receiving medical care and where, the nature and condition of the house and rooms in which he lives, the number in the family, etc. She calls attention to any faulty conditions and recommends steps to be taken for their betterment. The case is kept under sanitary supervision and visited every few days until faulty conditions are corrected or recommendations carried out. Certain cases under a private physician's care may be visited from time to time

merely to ascertain if the patient is still on the premises and under the same physician's care.

Circulars of instructions in the language of the patient are given to the patient or the family.

In addition — and more important — the nurse personally instructs the patient and his family as to the precautions to be observed. All patients not under the care of a private physician are given a card to the tuberculosis clinic and urged to attend. All cases are revisited at least once in two months and advanced or refractory cases as much oftener as may be necessary.

Any other suspicious cases of tuberculosis among the family and neighbors are traced and reported. Should the patient be a child attending school, the nurse reports whether or not he or she should be excluded from school. The welfare of any sickly or anæmic children is looked after and they are protected against infection as far as possible. If necessary their admission to a fresh-air school, a day camp, or a preventorium is recommended on daily report. The nurse reports where treatment of rooms is required, and any necessary orders are issued by the office. Dirty and infected goods may be ordered disinfected without waiting for the termination of the case by death or removal.

If the patient is at work, the nurse reports as to whether the work is harmful to him or her, or a menace to fellow workmen, or if he or she is likely to spread infection to the public (bakers, handlers of foodstuffs, cooks, etc.). If any work is done at the home the nurse makes sure that no one is endangered thereby.

If the case is suitable for hospital or sanatorium care, she endeavors to induce the patient to enter an institution voluntarily, and submits a recommendation to that effect. All the above information is submitted by the nurse on the history card.

The nurse may be called on to deliver admission cards to tuberculosis hospitals to patients, and instruct them how best to reach the hospital, and as to outfit required.

The nurse devotes a certain portion of her time to work in the clinic. She thus familiarizes herself with the medical aspect of her cases, and her presence tends to promote friendly relations between the clinic, the patients and herself. She also calls the attending physicians' attention to anything specially worthy of note regarding the patients and their home surroundings.

The history card, already mentioned, gives a description of the house, the rooms, the family, the financial conditions, the physical condition of the patient, precautions observed, instructions given, and any recommendations.

One of these cards is given out for every new assignment (including

dead cases, those removed to the hospital or sanatoria, etc.). Duplicate histories are made out for all cases attending the tuberculosis clinic. Sometimes the patient will give a friend's or relative's address, where he has never lived. The history card is not filled out in such cases, unless the patient be seen. A new card is assigned whenever a patient changes his address, returns home after a considerable absence, or when conditions at home have changed.

When cases under care of private physicians are visited to order disinfection, etc., only the house history, location of rooms, how long the family has been in rooms, previous address, and name and address of physician or clinic caring for patient, are entered on the card. But when such cases are visited on complaint a full history is taken.

All recommendations are entered on history card, it being the official medium for handing in all recommendations.

Every nurse submits a daily report of her work for the preceding twenty-four hours. This report gives date, name, and district of nurse, total number of new visits, revisits, and extra visits, the name and address of each patient visited, and the hour when nurse reached the premises. On the reverse of the card is given a summary of the day's work, and the total number of hours on duty, subdivided into (1) on district, (2) at clinic, and (3) at office. At the close of each week, the totals of the various items in the summary on the daily report are entered on a weekly record sheet, which shows at a glance the amount and kind of work being done by each nurse. Each sheet covers a period of fifty-two weeks.

Throughout, the nurse works in close coöperation with health department, physician, clinic physician, health officer and inspectors. When the patient is bed-ridden and requires regular nursing she arranges for it with the district nursing organization. She also applies for charitable aid when necessary.

Duties of Health Department Physician Relative to Tuberculosis. — The health department physician acts as medical inspector in tuberculosis; he may also act as clinic physician.

All suspected cases of tuberculosis that will not or cannot visit the clinic may be examined at their homes by the physician. These cases are reported to the department of health by lay organizations, citizens, district nurses, inspectors of other city departments, etc. The physician submits a full history of the case on a history card. If a new case, a regular physician's report is also made out. Should the case prove not to be one of tuberculosis the words "not tuberculosis" are written

on the upper left-hand corner of the face of the history card. Any recommendations and special notes are written on the card. Should cleansing, renovation, or disinfection be necessary, it is ordered.

All special complaints, requests for hospital care, etc., are investigated by the physician, a history card being made out in every instance.

Cases of pulmonary tuberculosis in children under sixteen years of age, in which the attending physician will not certify in writing that patient can safely attend school, where the patients will not or cannot visit the clinic, or where a specimen of sputum is refused, are assigned to the physician. They are visited and examined, and a history card made out with a recommendation as to what action should be taken by the department. In investigating cases reported by the tuberculosis clinic for exclusion or readmission to school, the inspector consults with and obtains all information possible from the clinic before visiting the child.

The physician should also examine the children in the families of consumptives when there is no private physician.

The tuberculosis clinic is sometimes requested to send a physician to visit a clinic patient who is too ill to attend the clinic. Such calls are assigned to the physician, who visits the patient, prescribes if necessary, and makes out a history card recommending suitable action (usually removal to hospital). But the physician does not render continued medical service at the home. Monthly visits to patients living in lodging houses are made by the physician on request of the nurse. Some of the cases requiring continued medical care but not sent to the hospital may be referred to the town poor physician.

When forcible removal to hospital of a case of pulmonary tuberculosis is ordered, the physician makes all necessary arrangements, and is present at the removal. If in his opinion the patient is in a dying condition, he may suspend removal, submitting a written report to that effect.

When notice is received that a given case of tuberculosis has recovered, and no physician's certificate is forwarded, the case is assigned to the physician to visit and make a physical examination. He submits a history card as above stated.

Cleansing and Disinfection. — After the death or removal of a tuberculosis patient the room or rooms which have been occupied by him require attention. Deaths should be noted from the death certificates, and, as already mentioned, the law should require that physicians, landlords, etc., give prompt notice of the removal of patients

when known to them. In default of such procedure the removal of many cases is discovered only by the tuberculosis nurse.

The following processes should, so far as required, be applied to infected rooms:

(*a*) Cleaning-up, involving scrubbing of floors and woodwork, removal of dust by moist methods or vacuum, and airing.

(*b*) Application of simple disinfectant, such as crude carbolic or coal-tars in known strength,[1] to surfaces which have been exposed to infection by handling, etc.; appropriate disinfection (or destruction) of miscellaneous articles which have been exposed to infection; similar treatment for bedding.

(*c*) Formaldehyde fumigation, for disinfection of carpets, fabrics and surfaces not susceptible of treatment under above heads.

More or less general house-cleaning and disinfection may also be required.

Between the time when the patient departs and the completion of the measures ordered it is frequently the custom to placard the apartments with a warning that they are not to be reoccupied until the health department orders have been carried out and the placard removed by nurse or inspector.

In some exceptional cases, when the apartment is in good order and the patient has stayed only one or two nights, cleansing and disinfection measures may be omitted. In other such cases a simple formaldehyde disinfection suffices.

Formaldehyde disinfection is performed by the health department; cleansing and application of liquid disinfectants by the occupants, with assistance, if necessary, from health or charity authorities. Needed disinfectants should be furnished free of charge by the health authorities.

[1] See Appendix A. Coal-tars may be added to the soap and water used for cleansing.

In the course of weeks and months it is not unlikely that carpets, bedding, curtains, and other furnishings may become infected with tubercle bacilli, and special attention should be paid to articles of this class. Infected articles of this class which cannot be readily disinfected may, if of little value, be destroyed. The same rule applies to all articles of small value which have been in contact with or near the patient.

Tubercle bacilli in dried sputum may live for months, and thus disinfection is of greater value after this disease than after others whose viruses die much more quickly. However, cleanliness is as important as simple disinfection, and thorough cleansing is far more truly disinfecting than a superficial so-called disinfection.

3. **Institutional Care.** — Clinics and Dispensaries. — Among the various kinds of institutions for the care of tuberculosis, we may mention first the clinic or dispensary. With the tuberculosis nurse the dispensary stands as the most important single local agency for the detection and treatment of the disease. Persons who cannot afford the services of a private physician will visit a clinic with much benefit. Through it, also, the nurse has a means of keeping in regular touch with the patients and their condition. The clinic is usually, though not necessarily, operated in connection with a general hospital. The details of operation cannot be entered upon here. Patients in all stages may be kept under care, while the detection of incipient cases is an especially important function of the clinic.

Sanatoria and Hospitals. — For incipient and only moderately advanced cases there is the sanatorium. We do not refer to the many private sanatoria which exist, but to the public sanatorium to which indigent persons and persons of small means may go for the "cure." Every community should be able to send its cases to such an institution, whether it be maintained locally or by state or county. The regimen prescribed at the sanatorium has

the object, not only of cure, but also of inculcating correct habits, so that when the patient returns home he will live according to hygienic principles, and by his example lead others to do so.

Patients returning from sanatoria should be "followed up" by the tuberculosis nurse, as they tend to relapse into their former condition and habits.[1]

Advanced cases are usually, though not necessarily, cared for in a separate hospital. It is of the greatest importance that provision for the hospital care of advanced cases be made in every community. Where one community is unable to maintain such a hospital alone, it may arrange with others to maintain a joint hospital, or there may be established a county institution.[2]

The most important effect of sanatoria and hospitals as regards the public health is the *segregation of infectious persons*. But the cure (so far as possible) of those persons and their return in a relatively able and non-infectious condition are also important considerations in the social problem due to tuberculosis. The object of segregation applies with special force to the advanced cases, which shed the germs in much greater numbers. It sometimes occurs that the curable cases are looked after while the very advanced and potently infectious cases have comparative freedom to spread the disease.

Progress in regard to segregation measures has been slow for the reason that the public has only lately become convinced that tuberculosis is a truly communicable disease, and that, while it may not be subject to the same rigid isolation as some other communicable diseases, it nevertheless demands strict prophylactic measures. When the rules laid down for home life (see above) are obeyed and the patient can live a proper life at home without mate-

[1] This danger was brought out by investigations in Massachusetts. See *Am. Jour. Pub. Health*, 1912, vol. II, no. 6, p. 494.

[2] See note, next page.

rially endangering others, then well and good. But if a proper regimen cannot be obtained at home, and especially when *the patient, through invincible ignorance or carelessness, is a menace to others, then hospital segregation is a necessity.* It follows that health authorities should have the power, when persuasion fails, to remove such cases to the hospital. The following are the grounds for forcible removal and hospital detention in New York City, which has practiced such removal since 1901: (*a*) that the patient's sputum contains tubercle bacilli; (*b*) that the patient either will not or cannot observe the necessary precautions as to disposal of sputum; and (*c*) that others (especially children) are exposed to infection. If all of these conditions exist removal is deemed necessary. In New Jersey a recent statute provides that the State Board of Health may lay down certain rules to be observed by tuberculosis patients, that such rules are to be imparted to the patient by the local health authorities, and that if the patient persistently disregards them he may, upon due process of law, be removed to the segregation hospital. The law further makes mandatory the establishment of a tuberculosis hospital in each county.[1]

[1] "The New Jersey bill providing for compulsory segregation of tuberculosis, has been signed by Governor Wilson and is now in force. The law is without doubt the most advanced state legislation on tuberculosis that has ever been enacted in this country, if not in the world.

"The new law provides that tuberculosis patients who refuse to obey the regulations laid down by the State Board of Health concerning the prevention of their disease, and thus become a menace to the health of those with whom they associate, shall be compulsorily segregated by order of the courts, in institutions provided for this purpose. If such a patient refuses to obey the rules and regulations of the institution in which he is placed, he may 'be isolated or separated from other persons and restrained from leaving the institution.' The State Board of Health, working through the local boards is given the power to enforce the provisions through the courts. The law further provides that all counties in the State of New Jersey shall within six months from April 1st, make provision in special institutions for the care of all per-

It is unfortunate that there is a popular mistrust of tuberculosis hospitals — we refer particularly to those for advanced cases — on the part of patients. This mistrust is very likely owing to the fact that such hospitals are sometimes conducted in conjunction with general contagious disease hospitals, that they become known as hospitals for hopeless cases, and that patients returning from them describe the conditions as depressing. Some of these objections would be removed if cases in all stages were treated in the same institution, being simply separated in pavilions. Such an institution should be quite separate and distinct from the isolation hospital for other diseases; and if conditions were made as cheerful as possible there should be none of the present popular objections, and compulsory removal to the hospital would rarely be necessary. It might thus also be possible to avoid the name "hospital" in favor of the more euphemistic title "sanatorium." Such institutions should be convenient to centers of population.

sons having tuberculosis in these counties. The state treasury will subsidize each county to the extent of $3.00 a week for each person maintained in these institutions except those who are able to pay for the cost of maintenance.

"The only other state which provides for compulsory segregation of dangerous cases of tuberculosis, is Maryland. The only city in the United States which has adopted a special ordinance providing for compulsory removal of dangerous tuberculosis cases, is San Francisco. A few other cities, such as New York, exercise this power under certain provisions of their sanitary codes, but no other city has any special ordinance on the subject.

"New Jersey now [1912] has two county hospitals in operation, one in building and one about to be started. It is expected that the new law will materially increase the number of such institutions because of its mandatory character. Anti-tuberculosis workers will also watch with much interest the way in which the provisions for compulsory segregation and detention work out." (Statement of National Association for the Study and Prevention of Tuberculosis, quoted in *Am. Jour. Pub. Health*, May, 1912.) New York State also now has such a law (1914).

Other Agencies. — Mention at length need not be made of the various other agencies existing for the treatment or prevention of tuberculosis. There are day camps for tuberculous children and adults, outdoor sleeping colonies, "preventoria," and the like, conducted for the most part by voluntary organizations. The Association for Improving the Condition of the Poor, of New York City, has carried out some experiments to demonstrate how poor people may be cared for in their homes.[1] In the schools the "fresh air" movement has resulted in the establishment of open-air classes for children who are anæmic or not up to physical par, and separate open-air classes for children having latent tuberculosis. The essential points in the regimen are work and rest in very freely ventilated rooms (sitting-out bags and the like being provided in cold weather) and nutritious lunches. The results in physical gain obtained in such classes are in many cases very striking. Diet kitchens and similar institutions which furnish milk and eggs at cost or free to needy tuberculosis patients deserve mention as parts of the general scheme. Playgrounds and all other agencies which tend to promote health and vital resistance are valuable factors in the antituberculosis movement.

The condition of the mouth and teeth of consumptives is of great importance, and dental clinics should be available, both for hospital applicants and for patients remaining at home.

4. **Popular Educational Measures.** — Popular education is of greater value in relation to tuberculosis than to perhaps any other preventable disease. Since many of the conditions favoring tuberculosis can be obviated or dealt with by the citizen — and particularly those involved in personal hygiene — the benefits of publicity are evident. Furthermore, the principles of prevention are simple and lend themselves readily to publicity methods.

[1] "The Howe Hospital Experiment," 1914, Assn. Imp. Cond. Poor, 105 E. 22nd St., N. Y. City.

Various means of publicity suggest themselves. Leaflets, cards, posters, and other printed matter may be distributed at lectures, through the schools, in stores, and so forth. Then there should be lectures, preferably illustrated.[1] Special benefits are obtained through informal talks given in schools, in factories, before labor organizations, clubs, and the like. If there is a local moving picture theater, the interest of the manager should be secured to show one or more of the films dealing with tuberculosis, the performances being publicly approved by the health officer.

It is now the custom of the National Association for the Study and Prevention of Tuberculosis to appoint annually in the spring a "tuberculosis day," which should be the occasion of special efforts in publicity work, particularly through meetings, addresses, exhibits, etc., the health authorities coöperating with local organizations. In the schools brief talks suited to the intelligence of the various classes and emphasizing the value of the simple principles of personal hygiene may be given, and the pupils may write essays, perhaps for prizes. On this annual occasion the aim is not to obtain funds for tuberculosis work, but popular education pure and simple.

Exhibitions or small exhibits, separate or in connection with general exhibitions, are of great value. They should be graphic, simple, and not "gruesome" but emphasizing hopeful principles, and may be the occasion of talks and distribution of literature.

And in all of this the invaluable coöperation of the newspaper press should be obtained. For further remarks on publicity work see Chapter X.

As to the *ideas to be set forth*, which should be simple, the following points should be specially dwelt upon:

[1] The Nat. Assn. for Study and Prevention of Tuberculosis, 105 East 22nd St., New York, furnishes a list of slides which may be obtained through it, also information regarding tuberculosis motion pictures.

(1) Warning as to the general *nature of the disease* and the conditions which favor it.

(2) The importance of recognizing the *early symptoms;* and insistence on the fact that tuberculosis in its early stages is curable, while in the later stages arrest or cure is difficult when not impossible. One of the chief hopes in the tuberculosis campaign lies in the earlier recognition of cases (thereby promptly indicating sources of infection and leading to steps to restore the patients themselves to health). This depends partly upon the establishment and recognition of dispensary facilities for the poor who would otherwise have no medical attention, but most of all upon the individual himself.

(3) The value of *hygienic habits* regarding fresh air, proper exercise, food and rest, temperance in all things, and other conditions which promote vital resistance. These factors, in varying kind and degree, apply both in preventing the disease in the well and in treating the sick.

(4) Condemnation of the unnecessary, filthy and dangerous promiscuous *spitting* upon public sidewalks, in public buildings, and the like. The board of health should forbid it by an effective ordinance, to which public attention should be called. While the virulence of tubercle bacilli in dust is still in dispute, it needs no argument to show that *sputum* from sidewalks may be tracked into houses on shoes and skirts, there to infect the floor upon which children play and very possibly the house atmosphere. And since there is no way of recognizing who are tubercle-distributors and who are not, promiscuous spitting should be forbidden to all at all times. In the streets, persons may of course spit in the gutters; in public buildings, offices, etc., destructible (or at least readily cleansable) cuspidors should be provided. The old-fashioned cuspidor, designed for appearance rather than facility of keeping clean, may be replaced by the impervious paper variety now on the market, or by sawdust in boxes, both of which

require no disinfectants and may be periodically collected and burned.

5. **Sanitary Supervision of Dwellings, etc.** — Under this head we include supervision of dwelling houses (particularly tenements), factories, schools, etc., a subject which will be taken up in a later chapter. Cleanliness, light, and ventilation are the chief points. All measures promoting the general health of the population, being effective against tuberculosis, may also be mentioned here.

6. **Prevention of Tuberculosis Infection through Milk.** — The proportion of tuberculosis derived from milk is estimated at about 7 per cent. This subject will be taken up in detail in Chapter III, under Milk Supplies.

7. **General Coöperation of All Anti-Tuberculosis Agencies.** — At the present time a great deal of work in the tuberculosis campaign is being carried on by voluntary organizations. Some of this is work which should be — and in future will increasingly be — maintained by the health authorities by means of public funds, though a certain proportion will doubtless fittingly remain under the control of private organization. The health officer should foster close coöperation with all of these, exchanging reports, data, etc. He should, moreover, in consultation with the various organizations, work out a detailed plan by which the whole work in tuberculosis is coördinated and systematic relationships and functions are established.

In conclusion, we may note the progress already made in the tuberculosis movement and the hopeful auguries for the future. The most recent census mortality statistics show that the tuberculosis death rate for the Registration States decreased from 189 per 100,000 population in 1901 to 159 in 1911. In New York City the decrease was from 230 to 175. Hoffman has recently shown that since 1881 the death rate from tuberculosis in American cities (excluding the colored population) has dropped off fifty per

cent.[1] While it would be quite unwarrantable to ascribe all of the decrease to sanitary control — for allowance must be made for improved diagnosis, treatment, living conditions, etc. — nevertheless the effects of the tuberculosis campaign are distinctly being felt.

The proportion of public (as compared with private) funds now stands at about three-quarters of the total spent on tuberculosis work and is steadily increasing.

The public attitude is hopeful, in that knowledge of the means of prevention is now much more widespread than ever before. It is doubtful, indeed, whether some of the popular propaganda has not been carried to an excess. Thus, for example, the idea of the communicability of the disease has given rise to the perversion of "phthisiophobia" (fear of consumption), which leads to unnecessary ostracism of practically harmless patients. Such fear has also made it unnecessarily difficult to establish sanatoria and hospitals near other dwellings. To dispel such ideas it should be taught that practically nothing is to be feared, even in the family, from a consumptive *if* the necessary precautions are strictly followed out; and that there is no danger from ordinary tuberculosis institutions. It is frequently advantageous to locate such institutions in built-up districts, and no reasonable opposition should be encountered.[2]

While the future is hopeful, a word of caution is in order. The leaders in the tuberculosis movement deprecate over-enthusiastic expectations of declines in case- and death-rates. Many factors are involved — social, economic, hygienic — many of them beyond the control of the public

[1] F. L. Hoffman, "The Decline in the Tuberculosis Death Rate" (abstract of a paper read before the National Association for the Study and Prevention of Tuberculosis, May, 1913), *Jour. of the Outdoor Life*, December, 1913. (See also editorial in same issue.)

[2] See "The Effect of Tuberculosis Institutions on The Value and Desirability of Surrounding Property," Nat. Assn. for Study and Prev. of Tub. (pamphlet, 10 cts.).

authorities — and each successive diminution of the rate becomes more difficult. Still, thorough application of principles now recognized will bring great, though gradual, results.

REFERENCES

The literature of tuberculosis is very extensive, and we can here give only a few leading references, necessarily omitting a number of works of value, especially those of a more or less popular character, as well as those on medical aspects, which would be included in a longer list.

Perhaps the simplest general presentation (non-technical, but thorough) is contained in Knopf's " Tuberculosis as a Disease of the Masses, and How to Combat It," International Prize Essay, obtainable of the Survey, 105 East 22nd St., N. Y. City (25 cents). Also printed in foreign languages. Especially useful as a basis for publicity. By the same author: " Tuberculosis: a Preventable and Curable Disease — Modern Methods for the Solution of the Tuberculosis Problem " (Moffat Yard and Co.).

Newsholme, " The Prevention of Tuberculosis " (Dutton).

Von Behring, " The Suppression of Tuberculosis " (translated by Bolduan).

Billings, " Handbook of Help for Persons Suffering from Pulmonary Tuberculosis " (J. W. Pratt Co.).

Carrington, " Fresh Air and How to Use It " (Nat. Assn. for Study and Prevent. of Tub.).

Rogers, " A Working Program for a Small City " (State Charities Aid Assn., 105 East 22nd St., N. Y. City).

Carrington, " Tuberculosis Hospital and Sanatorium Construction " (Nat. Assn. for Study and Prevent. of Tub.).

Various publications of the National Association for Study and Prevention of Tuberculosis, 105 East 22nd St., New York City (*Ann. Transactions*, Directory of associations, etc. and legislation in U. S., *Journal of the Outdoor Life*, Monthly Bulletins, etc., also *Transactions of the International Congress on Tuberculosis*, 1908). For information on special topics in the tuberculosis campaign (e.g., local organization, legislation, etc.) apply to the National Association. Various State Associations also issue useful literature.

Papers in *Transactions of the XV International Congress on Hygiene and Demography*, 1912, vol. IV, pt. I.

Other diseases of this class — such as influenza, common colds, mumps, etc. — may be spread by contact infection,

but do not require action by health authorities; although in some places quarantine is required for mumps. Influenza ("grippe") is readily communicable, has many carriers and is an important cause of death in infants and the aged, facts to which public attention should be called.

Smallpox is considered under Section IV.

II. DISEASES SPREAD LARGELY THROUGH EXCRETA

TYPHOID FEVER

Typhoid fever (enteric fever) is the principal of the diseases spread through the alvine discharges (feces and urine), and constitutes one of the most serious sanitary problems in the United States to-day.

Typhoid fever is an infection due to the *Bacillus typhosus* (or *typhi*), commonly called the typhoid bacillus, which enters the body through the alimentary canal and is shed off in the feces and urine of the typhoid patient. Typhoid fever does not arise spontaneously from filth, although propagated through infected filth; every case is derived from an antecedent case. While the bacillus primarily enters and proliferates in the mucous membranes of the intestines, it produces a general systemic infection which attacks other organs, with more or less acute symptoms of fever, intestinal disturbance, collapse, etc. It is not infrequently complicated with other diseases — e.g., pneumonia, the deaths from which are sometimes reported as due to "typhoid pneumonia," an incorrect term. The effect of typhoid in lowering vital resistance produces a liability to other diseases, such as tuberculosis.[1]

[1] Dublin (*Am. Jour. Pub. Health*, 1915, vol. V, no. 1, p. 20) estimates that in the United States "each year a minimum of close to 8000 deaths occur which can be attributed to the impairments which follow typhoid fever."

Transmission. — The typhoid bacilli commonly leave the patient mainly in the feces and urine.[1] The feces must be regarded as infected throughout the duration of the disease, from even before the fever and until convalescence is complete. The bacilli commonly appear in the urine some time after the onset of the disease; hence the urine also should be regarded as infected throughout the course of fever and convalescence.

The patient commonly ceases, during convalescence, to be infectious. In some instances, however, the emission of germs continues after recovery, in persons who become *carriers*. The whole theory of carriers and mild and atypical infection, as already discussed, applies to typhoid fever. Some cases are so mild that they pass unrecognized. In others, the patient is unwell, but does not feel ill enough to go to bed: these are the "walking typhoid" cases which are especially dangerous in spreading the disease. Finally, as first remarked, there are the recovered carriers who continue to emit virulent typhoid bacilli in the feces or urine for weeks, months or even years after apparent recovery. "In about 4 per cent of all cases of typhoid fever the patient continues to shed typhoid bacilli in the urine or feces during and after convalescence " (Rosenau). There are also carriers who give no history of ever having had the disease. We shall allude to the carrier problem again presently.

The bacilli shed by the sick or by carriers pass to the well in a variety of ways, direct or indirect, mentioned below. They enter the mouth with some article of food or drink, or simply by carriage to the mouth by infected fingers.

The following are the principal modes of transmission:

1. CONTACT. — Typhoid fever is contagious in the sense that it can pass directly from patient to victim by certain

[1] As to other discharges: "The sputum does not ordinarily contain the bacilli unless there is a pneumonia or severe bronchitis. The bacilli may be eliminated with the discharges from abscesses, such as periostitis, months and even years after the disease." (Rosenau.)

modes of contact infection (see page 113 ff.). For example, in Washington, D. C., careful investigations in recent years placed the amount of contact infection at 15 per cent or more of all cases. Incalculable harm has been done by the false statement that "typhoid fever is infectious but not contagious," implying that it is not transmitted directly from one person to another. All that is necessary is that the infected excreta contaminate the fingers of nurse or other associate of the patient, or some object by which the fingers may become contaminated. Thence infection by mouth is easy, directly from the fingers or through food or drink. Thus it may pass just as easily from person to person as diphtheria or scarlet fever. The patient or nurse may infect food to be eaten by other persons. Such is all true contact infection, chiefly through the agency of *infected fingers*.

2. WATER. — We pass now to the less direct but nevertheless highly important modes of transmission. One of the chief of these is transmission through water. Water-supplies become infected through the improper disposal of the undisinfected excreta of typhoid patients, and may then spread the disease very widely. Many epidemics of water-borne typhoid fever are on record. To illustrate the vast dangers of water infection, note, for example, the Plymouth, Pa., epidemic (page 278), in which, through the infection of a town water-supply, a single case gave rise to 1104 cases with 114 deaths.

Epidemics of water-borne typhoid fever have not infrequently been foreshadowed by outbreaks of intestinal disease, the latter occurring some days in advance of the former. Thus at Rockford, Ill., in 1912, in a population of 45,000 there occurred some 10,000 cases of diarrhœal disease, followed by 200 cases of typhoid fever.

Ice may also be considered a possible vehicle of typhoid fever, though there are no clear epidemics of ice-borne typhoid on record. In the one epidemic (Ogdensburg, N. Y.)

attributed to ice, the evidence is not at all convincing (page 418). The reason that ice has not figured prominently in typhoid fever transmission doubtless is, that both the freezing and the storage of ice are bacteriologically purifying processes.

3. MILK. — In milk we again find a dangerously ready vehicle of infection for typhoid fever. Typhoid bacilli readily live in milk and, except at low temperatures, thrive in it. The extreme severity of some milk-borne epidemics in which the original infection of the milk-supply was slight are explained by the multiplication of the bacilli in that medium. Many extensive epidemics of milk-borne typhoid have occurred (page 281 ff.). Supplies become infected through cases or carriers among employees in dairies or milk-handling establishments, or the infection may be introduced into the supply indirectly by employees who have been in association with patients or carriers. Milk bottles or other apparatus may become infected through the use of an infected water-supply for washing them. Milk bottles may also be infected in the families from which they are collected. In an instance under the observation of the writer such bottles apparently infected a washing tank and other bottles washed in it.

Milk products and ice-cream are also potential vehicles of the disease.

4. FLIES. — Flies may readily convey infection from exposed infected excreta to food. This fact is expressed in the alliterative or catch-phrase "from flies and filth to food and fever." The conveyance of fecal matter on the feet of flies has been clearly demonstrated. The amount of infection by this means varies according to circumstances. In a well-sewered, clean community where the excreta of the sick are properly disinfected, comparatively few cases could be due to fly transmission. On the other hand a maximum of fly infection is reached where excreta are improperly disposed of, flies swarm, and food is exposed.

Such conditions obtained in the United States Army camps in the Spanish-American war, when, it is estimated by the army medical authorities, 15 per cent of the numerous cases were due to fly transmission.

5. SHELLFISH. — Oysters and other shellfish grown (or, in the case of oysters, "floated" for fattening purposes) in polluted waters may convey typhoid infection.[1] The typical example is the epidemic at Wesleyan University, Middletown, Conn., in 1894, where 25 (one-quarter) of those who attended banquets where infected oysters were served on the half-shell developed typhoid.

6. RAW VEGETABLES AND FRUITS, AND OTHER FOODS. — Vegetables may become infected through fertilization with fresh night-soil or sewage. This mode of transmission is not very common, but infection has been traced to water-cress grown in polluted water, and sporadic cases similarly arising unquestionably occur. Other foods (e.g., fruits, bread, cake, candy, etc.) subject to handling or other mode of infection, and eaten raw, may also convey the infection.

The following diagrammatic representation of the modes of spread of typhoid fever is adapted from Stiles and Lumsden:

$$\text{Excreta from}\left\{\begin{array}{l}\text{Typhoid patients}\\ \text{or}\\ \text{Typhoid germ carriers}\end{array}\right\}\text{to}\left\{\begin{array}{l}\text{Fingers (direct or infecting food)}\\ \text{Flies (infecting food)}\\ \text{Water}\\ \text{Foods}\left\{\begin{array}{l}\text{Milk (and milk products)}\\ \text{Shellfish (oysters, etc.)}\\ \text{Vegetables, fruits, and other foods eaten raw}\end{array}\right.\end{array}\right\}\text{to}\left\{\begin{array}{l}\text{Mouths of persons}\end{array}\right.$$

[1] Pease, "Relation of Oysters to the Transmission of Infectious Diseases," *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. IV, pt. I.

In general, water, milk, and contact infection are most common; transmission by flies, by shellfish, and by other foods eaten raw is less common, but still to be considered. Other and minor modes — e.g., by soiled linen and other "fomites"— suggest themselves. The importance of contact infection of the various kinds has been on the whole overlooked, though it has been emphasized in the catch-phrases "flies, fingers and food" (Sedgwick), "dirt, diarrhœa and dinner" (Chapin).

Contact infection is of particular importance in connection with what is known as *residual typhoid.* The term is applied to the unexplained typhoid fever which still remains in a community having a pure or purified water-supply and in which all definitely known sources of the disease have been eliminated. This residual typhoid is spread by unseen contact infection, frequently from unrecognized cases, passing directly from person to person or indirectly through sporadic infection of food and drink. This simply means that typhoid fever, like a number of other infections, is endemic — i.e., constantly present. The term "prosodemic" ("proceeding through the population") has been suggested in this connection by Sedgwick as emphasizing the unrecognized chain-like paths by which the disease is propagated. The term "normal," meaning "usual," is sometimes applied to residual typhoid, but is unfortunate in that it favors tolerance of a residual which may, through popular education in personal hygiene and through care on the part of health authorities, be still further reduced.

Incidence. — Considering its preventability, typhoid fever occurs to an undue extent in the United States as compared with other civilized countries. In the Registration Area in 1911 the death-rate was 21.0 per 100,000 population. Certain individual cities ran as high as 65, while the rates for others were under 5, a striking demonstration of the fact that the higher mortalities are avoidable.

McLaughlin (quoted by Rosenau) has shown that in 1910 there was an excess of deaths in American cities, as compared with principal European cities, of 18.5 per 100,000, the contrasted figures being 6.5 and 25.0.

The greater part of typhoid mortality falls on the middle periods of life (over half at 20–50 years, maximum specific death rate at 20–25).

The fatality, or case mortality, of typhoid fever is usually taken to be about 10 per cent, probably somewhat less if the mild cases detected by advanced methods are counted in. Conversely, it may be estimated that, on the average, *for each typhoid death recorded there are at least ten cases.*

The seasonal incidence of typhoid fever varies. Where the water-supply is typhoid-free, the greatest number of cases occur during the summer months, the numbers following approximately the temperature curve. This may be explained by the more favorable conditions for the germ at large, by fly-infection, and by the more susceptible condition of the gastro-intestinal tract in warm weather. On the other hand, if the water-supply is much infected, there occur in addition to the summer rise irregular rises at various times, corresponding to the amount of infection gaining access to the water, currents (in lakes), the effects of freshets in washing infection from the banks of streams and bearing it rapidly, and other such factors.

We need not discuss the question as to whether typhoid fever is rather a rural or an urban disease. It is both. While urban conditions are on the whole more favorable to its spread, bad conditions as to disposal of excreta in rural districts also favor infection. While the actual amount of typhoid in the country districts may be less, it may readily be communicated to city dwellers through milk and other food supplies and through vacation visits to unsanitary farm places. Though "vacation typhoid" has perhaps too often been made the theoretical scapegoat for

city cases occurring in the fall season, it has nevertheless a real significance, and due attention should be paid by vacationists and public authorities to the sewage disposal and water supplies of farms and summer resorts.

In mining camps, construction camps, and primitive communities where there is improper disposal of excreta, typhoid fever may occur heavily. The remedy is proper care of cases, sanitary privies (see Chapter VI), and, when need be, anti-typhoid inoculation.

In dealing with typhoid fever statistics, one must bear in mind the possible inaccuracy of diagnosis (some cases being reported as "malaria" or the improper term "typhoid malaria") and the unfortunate tendency to report deaths as due to mere terminal symptoms — e.g., pneumonia — instead of the disease itself. The terms which are still occasionally met with, — "intermittent fever" and "remittent fever," used as practically synonymous with typhoid, — should never be used. "Enteric," the English term for "typhoid," is sometimes met with.

Protective Inoculation. — There is no specific serum remedy for typhoid fever. Immunity may, however, be conferred by a process similar to smallpox vaccination. Killed cultures of typhoid bacilli are injected at intervals of five days at least three times, whereby the subject develops an immunity.[1] This inoculation should be taken by all who nurse typhoid patients or are otherwise directly and unavoidably exposed. Results obtained in the U. S.

[1] The technique, however, varies. See Rosenau, "Preventive Medicine and Hygiene," 1913, p. 94. Also: Hachtel and Stoner, "The Use of Anti-Typhoid Vaccine in Public Institutions and Among Civilians," *Am. Jour. Pub. Health*, 1912, vol. II, no. 3, p. 157; Force, "Institutional Vaccination Against Typhoid Fever," *Am. Jour. Pub. Health*, 1913, vol. III, no. 8, p. 750; Spooner's and Goltman's accounts of their experiences with anti-typhoid inoculation among nurses and the public in *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. IV, pt. I; and a summary of the subject by Townsend in *Am. Jour. Pub. Health*, 1914, vol. IV, no. 11, p. 993.

Army have clearly demonstrated its high efficacy. In an encampment at San Antonio, Texas, during four months ending July 10, 1911, among 12,801 men inoculated no typhoid fever developed. The only two cases which occurred in the encampment were those of a teamster who had not been inoculated and of a hospital corps man who had not completed the required inoculations. During the same period considerable typhoid fever occurred in the civil population in the neighborhood. The record of these troops contrasts markedly with that of the Spanish-American War, when one-fifth of the troops developed the disease.

It is advisable that persons who take the typhoid fever inoculation be in good health, for the process apparently has some tendency to revive old chronic affections (e.g., tuberculosis) and cause them to become acute. Instances of this tendency are, however, infrequent, and do not constitute a serious drawback in the use of this valuable prophylactic measure.

CONTROL

Sedgwick has epitomized typhoid prevention in the dictum that the problem is "to keep the excreta of A out of the mouth of B." In this definite sense typhoid fever is a filth disease. The dictum refers not only to the known case but also to the disposal of all excreta and sewage, for all must be considered as, potentially at least, infected. The same authority has further said that "every case of typhoid fever comes from somebody's ignorance or neglect." The statement certainly applies to all recognized typhoid cases and carriers; as for the undetected cases and carriers, they constitute a separate and distinct problem which will be taken up presently.

The following measures should be carried out by the health authorities:

1. **Registration of Cases.** — Physicians should be required to report typhoid fever precisely as diphtheria or

any other acute communicable disease. Histories of the cases should be regularly taken and studied.

The local health authorities should make provision for ready *bacteriological diagnosis*, either locally or by a state laboratory. This is of great importance not only in the treatment of the case but also in the protection of the community. The most effective method for *early* diagnosis is by *blood cultures*. According to this method a small quantity of blood is drawn and incubated by a special method which shows up the typhoid bacillus if present in any considerable numbers. Since the bacilli appear in the blood early in the disease, the diagnosis may thus be promptly established. Later in the course of the disease the blood serum has the property of causing agglutination (clumping) of typhoid bacilli, giving what is known as the *Widal reaction*, which is frequently used as a diagnostic test. In this test one or two drops of the blood may, if necessary, be dried and sent to a distance for examination. The method is simple, prompt and easy, but of little or no value in early stages of the disease. The reaction does, however, persist after recovery, and may therefore determine that suspected persons have had typhoid fever or are carriers.[1] In comparing the blood culture method with the serum reaction method it should be remembered that the bacilli are present in the blood throughout the whole course of the fever, and may be detected in a large proportion of the cases, whereas the Widal reaction may not be constantly present even after the second week and may therefore more readily be missed. Hence for a complete diagnosis of an obscure case by the latter method the tests should, if negative, be repeated daily for some days. The *feces and urine* may also be examined for the presence of the bacilli (see below).

In connection with the blood tests it should be remem-

[1] It is important to note that persons who have had the protective typhoid inoculation also carry a positive Widal reaction.

bered that the methods are not infallible and that one negative result is not conclusive. In case of doubt as to clinical symptoms, while further tests are being awaited, the case should be regarded as possible typhoid and precautions taken accordingly.

2. **Isolation and Disinfection.** — Since typhoid fever is truly communicable by contact, cases should be isolated and the feces and urine should be carefully disinfected.[1] The sick-room, but not necessarily the house, should be placarded. If, under satisfactory conditions, visitors are admitted, they should not touch anything and should

[1] See methods, p. 582 ff. The following procedure has been adopted in the rural districts on the water-sheds of Baltimore:

" Special disinfecting outfits are distributed to the homes of the patients by an inspector and full, printed directions for their use are left. The attending physician, nurse or attendant is also furnished with a copy of instructions. An inspector carries a ' standard package ' of disinfecting appliances to the house, unpacks it, makes up solutions and explains their use. Enough disinfectant is left for 4 weeks. After recovery of the patient the inspector removes the appliances, which may be used again. The outfit consists of: 2 five-gallon buckets, phenol (90 per cent), urinal, enamel basin, corrosive sublimate tablets, bed-pan, enamel measure, lactose bile outfit, mosquito netting canopy. Directions for the use of the outfit are very full and plain, including instructions to physician, attendants and inspectors, and a copy of the law applying to these cases. [Cf. methods, p. 582 ff.]

" When disinfection of stools is about to be discontinued a specimen of the stools is sent in the bile tube provided to the laboratory, where it is examined for typhoid bacilli. It is required that stools of a convalescent be disinfected until the typhoid bacillus is no longer present. . . . It is the authors' belief that negative cultures should be required of typhoid cases just as much as of diphtheria cases. By careful disinfection and examination until negative cultures are obtained, they believe that the starting point of what might be, otherwise, many cases of typhoid fever can be removed, and that this is the most important source at which to attack the spread of typhoid throughout the community." (Price, Stokes, and Rohrer, quoted in *Am. Jour. Pub. Health*, 1912, vol. II, no. 1, p. 64.) Cf. Grandy and Andrews, " Municipal Control of Typhoid Fever," *Am. Jour. Pub. Health*, 1913, vol. III, no. 8, p. 746.

wash and disinfect their hands if they do so; pains should be taken to impress people with the fact that the disease is truly contagious. In no case should children be permitted in the sick-room. If satisfactory isolation and disinfection of discharges cannot be secured, the patient should go to the hospital; only thus can secondary contact cases be avoided.

The isolation should not be terminated until the patient has ceased to shed the germs in feces and urine. The patient commonly becomes free from infection during convalescence, but in the carrier cases the shedding of germs continues for a greater or less time afterwards. Discontinuance of the germs can be determined only by *cultural examination.* Rosenau recommends four consecutive negative examinations of feces and urine, but more practicable is the rule that no convalescent be released:

> until two consecutive negative examinations have been made of the stools and urine. If the patient's business brings him in contact with food supplies, four consecutive negative examinations of the stools and urine should be required. In case a person is found to be, in spite of all treatment, a chronic carrier of typhoid bacilli, he should be kept under competent supervision by the local board of health; he should not be allowed to engage in occupations requiring the handling of foodstuffs, and, in case he moves to another neighborhood, the local health authorities of that neighborhood should be notified at once.[1]

Even so, while a negative result from the urine is of the greatest possible value, a negative result from the stools is of practically no value for the reason that the excretion by the latter channel is very frequently intermittent. Hence some authorities even recommend examination of feces monthly for one year for all convalescents. This consideration of intermittency emphasizes the possible dangers from every typhoid convalescent and the necessity of instructing such persons to exercise scrupulous personal

[1] Pamphlet of the Massachusetts State Board of Health on the control of typhoid fever.

cleanliness.[1] The frequency of epidemics traced to carriers bears out this statement concretely.

No true cure for fecal typhoid carriers is known. The administration of urotropine, a urinary disinfectant, may, however, be employed to rid the urine of germs in convalescence. (For further remarks on carriers, see below.)

In comparison with the present generally lax practice in relation to control of the individual case of typhoid fever, the measures just described will perhaps at first sight appear impracticable. They are, however, based upon the best indications of the preventive medicine of typhoid fever. When the strict measures which in the past have been applied to diphtheria, scarlet fever, and other contagious diseases are considered, it would certainly seem that the same kind of measures should be accepted when indicated (as they are) as necessary for the effective attack on this no less serious public health problem. The local health officer should therefore carry them out to the greatest possible extent that coöperation of the public and of the medical profession will permit.

3. **General Protection of Water and Food Supplies.** — The prevention of the pollution and infection of water and food supplies (especially milk) is a large and important part of the defence against typhoid fever. These subjects are treated in detail in Chapters III and IV.

4. **Popular Education.** — Much can be done through publicity as to the methods of prevention, particularly upon the following points: avoidance of suspicious sources of water and food, especially in traveling or on vacations in rural districts; boiling of suspicious drinking water; home pasteurization of milk not so treated by the dealer; abatement of fly-breeding places and protection of foods from flies; general cleanliness, personal, domestic, and municipal; the contagious nature of typhoid fever; and the necessity for strict municipal control.

[1] Richardson, "Dirty Hands and Typhoid Fever," see p. 116.

5. Typhoid Vaccine. — Health authorities should encourage the use of protective inoculations for those who nurse typhoid patients and for others (e.g., travelers and vacationists) who may be exposed, and should be prepared to furnish a reliable vaccine free or at cost. But the use of typhoid inoculation as a general protective measure among the public at large is not feasible.

6. Carriers. — "In about 4 per cent of all cases of typhoid fever the patient continues to shed typhoid bacilli in the urine or feces during and after convalescence" (Rosenau).[1] Such carriers may be called acute or chronic, according to whether they harbor the bacilli for a shorter or longer time. There are also "temporary" carriers who have never shown clinical symptoms but who nevertheless harbor and excrete bacilli. Negative statements, however, as to their clinical history, on the part of suspected persons, should be sceptically received; not infrequently past illness, especially if slight, is forgotten or concealed.

In all these instances typical typhoid fever may be communicated by the carrier to well persons. It has been estimated that one person in every thousand of the general population is a carrier (Albert).

We have already alluded in brief (section (2) above) to the detection and control of carriers after convalescence.

In a *search* for carriers (e.g., at a dairy) Widal tests may be made of all suspected persons. Those who show a positive or doubtful Widal should then be subjected to bacteriological examination of stools and urine. In collecting samples for this purpose, the sanitary officer must be assured that the specimens actually are derived from the persons in question, for there may be deception on the part

[1] See also p. 109 of present volume. Richardson (*Am. Jour. Pub. Health*, 1914, vol. IV, no. 2) states that women carriers are five times as numerous as men and calls attention to the fact that women are more frequently employed in the handling of foods. He states that urinary carriers are more dangerous than fecal carriers. The latter, however, being intermittent, may escape detection.

of persons who suspect that they may harbor the bacillus. It should also be remembered that carriers are frequently intermittent and that a single negative result in stools is not conclusive. If a person is particularly suspected the examination should be repeated twice or more. By the use of tact, specimens for these examinations can usually be obtained. If, however, persons refuse, the health authorities should have power to restrain them until the examinations are permitted.

There are a number of *examples* on record of epidemics caused by carriers. "Typhoid Mary," the cook who distributed infection through a number of families by whom she was employed, is one of the best known examples. In New York City, in 1909, an epidemic of 380 cases was traced to a dairyman who was a typhoid bacillus-carrier of 46 years standing, thus illustrating the danger even from old cases (cf. page 284).

The administrative *control* of carriers is a vexed question. Persons who have had typhoid fever should certainly not be permitted to engage in the preparation or handling of foods eaten raw, particularly milk and milk-products, until their freedom from infection has been thoroughly established (see (2) above). Detected carriers cannot practicably be isolated, but should be kept under strict surveillance. No effective means of curing carriers is at present known. The urine of urinary carriers may be disinfected with urotropine, but no treatment is available for the class of fecal carriers. The surveillance of carriers should include forbidding employment in any occupation in which foods eaten raw are prepared or handled; this would bar out the milk industry, cooking, baking, confectionery and ice-cream making, nursing, etc. The whereabouts and occupation of the carrier should be constantly known to the health authorities, and periodic examinations of excreta should be made until a satisfactory number of consecutive negatives are obtained. Some

authorities recommend such examinations monthly for one year for all typhoid convalescents. Extreme measures will have to be taken in order effectively to cope with the carrier problem.

Carriers should be instructed as to the danger to others, and should carry out carefully instructions as to the cleansing and disinfection of their hands (page 584).

The existence, at large, of unrecognized carriers lends special weight to all measures for simple but scrupulous cleanliness on the part of all persons who handle foods which may act as vehicles of infection, also to the general protection afforded by pasteurization of milk-supplies. The importance of the carrier problem in typhoid fever can scarcely be overemphasized; upon its solution depends very largely the elimination of the mass, already referred to, of "residual" typhoid.[1]

Paratyphoid Fever. — Paratyphoid fever is caused by the paratyphoid bacillus, which is similar to the typhoid organism but distinguishable from it by laboratory tests. Clinically, also, the disease is similar to typhoid, and frequently can only be distinguished from it by bacteriological examination. Many of the cases are doubtless reported as typhoid fever. As in typhoid fever, the germ enters the body by way of the mouth and alimentary tract and is shed off in the intestinal discharges.

Paratyphoid fever does not occur as frequently as typhoid and rarely causes conspicuous epidemics. A peculiar property of the bacillus is its faculty for growing in meat, infecting the mass without affecting it in appearance, flavor, or odor (see page 400f.). This fact argues strongly for aseptic methods of cleanliness, for thorough cooking of meat, and for protection of it before eating. Otherwise prevention is the same as for typhoid fever: isolation of cases and disinfection of discharges, protection of water and food supplies, avoidance of fly infection, etc.

[1] Cf. also p. 108 ff.

REFERENCES

Whipple, "Typhoid Fever," John Wiley and Sons, Inc., 1908.

Bolduan, "Typhoid Fever in New York City, together with a Discussion of the Methods found Serviceable in Studying its Occurrence," *Am. Jour. Pub. Health*, 1912, vol. II, nos. 5 (p. 339), 6 (p. 431), 7 (p. 538). (Some of the principles suggested are applicable to typhoid fever study in small cities).

The Bulletins of the Hygienic Laboratory, U. S. Public Health Service, on "Typhoid Fever in the District of Columbia" (1907 ff.) illustrate expert investigation methods and contain valuable data.

CHOLERA

Cholera (more accurately Asiatic cholera, to distinguish it from other cholera-like diseases) is spread in very much the same way as typhoid fever. It is caused by the *Vibrio choleræ* ("comma-bacillus," from its shape), which enters the system by way of the mouth and leaves it in the bowel discharges (occasionally in the vomitus; not, however, in the urine). The vibrios may be detected in the discharges by bacteriological examination.

The measures of prevention are in principle the same as for typhoid fever. It is "contagious" in the same sense that typhoid fever is contagious, and strict disinfection of discharges, body and bed linen and other articles must be practised. Cases should be treated in a special hospital and should not be released until two successive examinations of the stools at 5-day intervals have proved negative. In epidemics cholera carriers exist. Immunity from cholera may be obtained by an inoculation similar in principle to the protective typhoid inoculation, which should be applied to nurses, physicians, and other persons exposed.

Since at the present time there is no cholera in the United States, the principal line of defence is the maritime quarantine, which maintains certain regulations for detention and examination of suspects that need not be detailed here.

DYSENTERIC DISEASES

Under this head we may group a number of communicable diseases characterized by dysentery or diarrhœa of known or unknown cause. These diseases are all communicable in the same way as typhoid fever, and prevention demands isolation with disinfection of bowel discharges, and avoidance of contact, water, food, and fly transmission. To determine the cause in any case, laboratory examination of stools is required, though practically this may not be necessary. Carriers may be more or less numerous.

First, there is *bacillary dysentery*, caused by types of the *Bacillus dysenteriæ*, which is closely related to the typhoid organism. The disease is truly epidemic in character, and may be spread in the same manner as typhoid fever, but it is not so extensive in distribution. It has frequently been noted in insanitary ships, jails, etc.

Again, there is a dysentery due to a protozoön parasite, *Entamœba hystolytica*, known as *amœbic dysentery*. It is chiefly a tropical disease. Although it does not occur in epidemics, it is spread in much the same ways as typhoid fever.

Finally, there are *various dysenteries and diarrhœas* of obscure causation, but communicable. Infants in particular are affected by intestinal diseases or disorders which are infectious and in some cases communicable. These are sometimes known by the indefinite titles "infantile cholera," "cholera nostras," "winter cholera," "summer complaint," etc. Such terms are unsatisfactory as being obscure and signifying no more than diarrhœa or enteritis, which may be communicable or may be merely symptomatic. Certain investigations have indicated that some forms of diarrhœa and enteritis in infants are communicable, and therefore *infantile diarrhœa should be made reportable and isolation and special cleanliness should be observed in such cases.* In many cases of infant diarrhœa the condition

is induced by improper feeding or clothing or unhygienic practices; all of which will be discussed in Chapter II.

Diarrhœal disease in the general population is frequently water-borne, and the occurrence of unusual numbers of cases of diarrhœa should raise a suspicion of the public water-supply. (See remarks under water transmission of typhoid fever.) Under such circumstances there may also occur secondary cases produced by contact infection, as well as numerous carriers.

Control. — Health authorities should require the same measures for diarrhœal diseases as for typhoid fever: *reporting; isolation* (or at least measures of cleanliness and *disinfection*); and should arrange for *laboratory examinations* when desired by the physician.

HOOKWORM DISEASE

Hookworm disease (uncinariasis or anchylostomiasis) is due to infection of the intestine with a small worm which produces anæmia, emaciation, loss of strength and ambition, and other forms of vital depression. Hence the name "miners' anæmia" and other similar designations of it. The disease is not only a seriously debilitating one in itself, but also strongly predisposes to tuberculosis and other infections. The eggs of the worm are shed off in the bowel discharges. The disease is chronic in character, the victims usually going about their usual occupations and frequently having no knowledge of their disease.

The problem of hookworm disease is largely one of soil pollution. While it may be transmitted by contact, polluted water, or polluted food, the entrance atrium being in these cases the mouth, the great majority of cases are contracted in the following way. The eggs shed by the hookworm victim hatch into larvæ, which infect the soil. These larvæ get upon the skin of the hands of persons touching the soil or of the feet of persons walking barefoot upon it. As soon as the larvæ touch the skin they

make their way through it, and then, by a roundabout route which need not be described here, to the small intestine. There they develop into adult worms, cling to the mucous membrane, and produce eggs which, as already remarked, pass off in the bowel discharges. The passage of the larvæ through the skin is attended with an inflammatory irritation which gives rise to the name "ground-itch" for this stage of the disease.

In the South (as in many tropical and subtropical countries), where improper disposal of excreta frequently prevails, where the temperature is favorable to the parasite, and where persons frequently go barefoot, hookworm disease is a very serious problem. Farther north, where these conditions are not so prevalent, it is not endemic; the fact that freezing kills the larvæ also tends to natural prevention in the Northern United States.

Control. — The chief measure against hookworm disease is *prevention of soil pollution.* This requires the extension of sewers and the use of proper privies in unsewered villages and country districts. The promiscuous and improper disposal of excreta in any other manner must be strictly prohibited. Personal prophylaxis through cleanliness, avoidance of contact with polluted soil, avoidance of polluted water and foods, and boiling of water from suspicious sources, goes without saying. Popular enlightenment, followed up by rigid administration of sanitary regulations, is necessary for thorough eradication.

Infected persons may readily be *cured* by administration of thymol or other suitable vermifuge.

III. DISEASES SPREAD BY INSECTS AND VERMIN

In this section we shall consider chiefly: malaria and yellow fever, transmitted through the bites of definite species of the mosquito; poliomyelitis (infantile paralysis), transmitted through the bite of the stable fly; various

diseases (e.g., typhoid fever) conveyed mechanically by the common house-fly; and plague, transmitted through the bite of the flea.[1]

MOSQUITO-BORNE DISEASES

MALARIA

The parasite (plasmodium) of malaria is conveyed from man to man by the genus *Anopheles* mosquito, and by no other means. The microörganism goes through certain parts of its life-cycle in man and through others in the mosquito, which is known as the intermediary host. It is acquired by the mosquito through biting the malaria patient, and is likewise transmitted to a new victim, after a sufficient number of days (about twelve) has elapsed for its development in the insect, through the bite of the infected mosquito. Several different varieties of malaria are known, caused by distinct microörganisms; these are known as quartan fever, tertian fever, and estivo-autumnal or tropical malaria, the first two of these names being derived from the number of days' interval at which the attacks recur. Carriers are thought to exist.

The distribution of the malarial mosquito and of the disease is irregular, but the disease occurs most frequently in southern and tropical climates where there are swamps and other accumulations of stagnant water and where a long warm season favors mosquito-breeding. While some regions are malaria-free, in others the disease constitutes a very serious problem. In 1911, 1802 deaths were ascribed to malaria in the Registration Area. In addition to the actual mortality there is great damage in the general debility (cachexia) characteristic of the chronic state of the disease.

[1] For fly and mosquito suppression see Chap. VI. For fuller treatment of the subject of insects and disease see Rosenau, "Preventive Medicine and Hygiene," Doane, "Insects and Disease," and other similar works. Cf. references, pp. 468, 474 f.

In malarial regions safety for the individual may be secured by living in screened houses and by protection against the bites of mosquitoes when out during the day. Where such protection is not feasible, prophylactic immunity may be secured by repeated doses of quinine. But these are only personal measures, inconvenient at the best, and in populated regions cannot take the place of general public measures.

Control. — The administrative measures for the control of malaria are:

1. *Registration of cases*, which is furthered by affording facilities for *diagnosis* through blood examination.

2. Effective *screening of the patient* against mosquitoes. Destruction of infected insects.

3. *Mosquito suppression* (see Chapter VI).

YELLOW FEVER

Yellow fever occurs under the same sort of circumstances as malaria. It is likewise conveyed through the bite of a mosquito, the causative microörganism being unknown but presumably a protozoön somewhat related to that of malaria. Yellow fever is, however, transmitted by a definite and distinct species of mosquito, the *Aëdes* (formerly *Stegomyia*) *calopus*. It is not conveyed by fomites — e.g., clothing — as was formerly thought, nor by any other means than the specific species of mosquito. The parasite requires about twelve days for its development in the mosquito, and the incubation period in the infected person is from two to five or six days. "All the experimental evidence thus far shows that the infection is absent from the blood after the third day, and that mosquitoes do not become infective after this period" (Rosenau).

Control is much the same as for malaria.[1] There is,

[1] Attention is called, however, by Rosenau, to the difference in amenability to control between the two diseases. Malaria is more difficult to eradicate because the breeding places of the Anopheles mosquito are

however, no bacteriological method of diagnosis and greater precautions should therefore be taken with suspected cases. The radical measure is of course mosquito suppression.

REFERENCES

Ross, " The Prevention of Malaria."
Boyce, " Yellow Fever and Its Prevention."

FLY-BORNE DISEASES

We must distinguish *two modes of disease transmission by flies:*

(1) Through the *bite* of the stable fly (*Stomoxys calcitrans*) the virus of infantile paralysis (see page 243) may be transmitted. Anthrax (page 250) may also be inoculated into man in the same way.

(2) Acting *mechanically*, through the conveyance of infected matter on its feet and proboscis, the common house-fly may carry the germs of typhoid fever, diphtheria, tuberculosis, infantile diarrhœa and enteritis, and other diseases. The ways by which infectious matter may be carried from privy-vaults and infectious discharges to milk and other food, infants' nursing bottles, and the like, have been indicated in previous pages under the head of typhoid fever, etc., and need not be elaborated upon here.

While the amount of disease conveyed by the fly is not exactly known, it is quite large enough, under either of the above heads, to justify measures of fly suppression. For such measures see Chapter VI.

more widely spread and difficult to detect and eliminate, those of the Stegomyia being practically confined to artificial containers in the neighborhood of human habitations; the Anopheles also travels farther. " Compared to yellow fever, the control of the malarial human host presents special difficulties. In yellow fever man is infective to the Stegomyia only a few days; in malaria the parasites continue in the circulating blood a very long time. In the case of malaria, then, we have to deal with chronic carriers, which, fortunately for us, does not occur in yellow fever. For malaria we have quinine as a prophylactic, whereas no known drug will prevent yellow fever." (" Preventive Medicine and Hygiene," 1913, p. 220.)

OTHER INSECT-BORNE DISEASES

PLAGUE

In the dissemination of plague, rats and rat-fleas play the most important part. This disease, caused by the *Bacillus pestis*, is "primarily a disease of the rat and secondarily of man" (Rosenau). It is transmitted to man by the bite of the rat-flea. (Suspicion has also been thrown on other insects.) In man it occurs in the bubonic, the pneumonic, and the septicemic types. In the second type, plague pneumonia, the sputum is highly infectious and the disease may be transmitted by contact. In the other types the bacilli are contained within the body. Mild, ambulant cases occur ("pestis minor").

Control. — Cases of the disease should be diagnosed as early as possible, for which purpose bacteriological facilities are indispensable. In emergency, traveling laboratories may be furnished by state or federal authorities in order that the service may be available promptly on the spot. Cases should be isolated and disinfection of all discharges practised. Persons subject to exposure may be immunized with Yersin's antiplague serum, or, better, by inoculation with Haffkine's prophylactic.

The radical public health measure is, however, destruction of rats and of other rodents (e.g., as in California, ground squirrels) which may become infected and transmit the disease through their fleas. The numbers of rats in all populated districts are enormous and much economic benefit as well as sanitary protection results from their suppression. Rats also play a part in the propagation of trichinosis and other diseases of man. An extended discussion of the methods of plague prevention through rodent extermination cannot be given here.[1]

[1] See Rosenau: "Preventive Medicine and Hygiene," 1913, p. 240 ff.; also "The Rat and Its Relation to the Public Health," Bull., U. S. Public Health and Marine-Hospital Service, 1910 (obtainable from the Surgeon-General, U. S. P. H. S., or the Supt. of Documents, Washington, D. C.).

Other insects and vermin — e.g., various fleas, ticks, lice, bed-bugs, etc. — have been incriminated or are suspected of transmitting various communicable diseases.

Typhus fever ("ship fever," "jail fever," "camp fever," etc.), for example, — which was once widely prevalent, though now rare, in civilized communities, — is transmitted solely through the bite of the louse. Typhus fever was once confused with (though now recognized as quite distinct from) typhoid fever; it has in recent years been rediscovered under the name of "Brill's Disease." It is prevented through the elimination of the louse. Its occurrence has naturally a close connection with filthy, overcrowded, unhygienic living conditions. Other diseases of this class, such as, e.g., relapsing fever (spread by ticks and other biting insects), are also rare under civilized conditions, being eliminated by cleanliness and freedom from vermin.

The other diseases of this class are chiefly of interest to students of tropical sanitation and parasitology and to quarantine officials, and need not be mentioned here.

IV. DISEASES HAVING SPECIFIC OR SPECIAL PREVENTIVE MEASURES

SMALLPOX

Smallpox (variola) is the most highly communicable of all the major diseases with which health authorities have to deal. But it is also, fortunately, the most surely preventable, for vaccination furnishes the means of making whole communities practically immune.

Transmission. — The smallpox virus, the exact nature of which is unknown, is present in the skin lesions. It is so "volatile" that contact infection very readily occurs. Smallpox and measles are alike in their extreme contagiousness. Smallpox has long been considered an air-borne infection. While there is evidence that this is to a certain

extent true, the tendency of modern authorities is to regard the radius of air infection as much smaller than formerly supposed. Certainly air infection out of doors is practically nil. Chapin, concluding a careful study of the evidence, asserts that "the evidence in favor of the aërial transmission of smallpox from hospitals is so slight that it should never influence a municipality in its selection of a hospital site."[1]

Not only the skin but also all discharges of any kind from the patient should be regarded as possibly infectious. Direct and indirect contact, fly infection, and even fomites, should be guarded against. The patient is infectious before the eruption occurs and possibly during the period of incubation.

INCIDENCE. — Smallpox may thrive anywhere at any time among susceptible persons of all ages and conditions. It shows no regularities of distribution, although it has a tendency to recur in waves separated by several years; this may be due to the growth of fresh material in the population. Its virulence varies from time to time. Although smallpox is not endemic in communities in this country, it is constantly present in small foci here and there in various States, and no community is immune from the possibility of an epidemic. A warning of this fact is to be seen in the 1913 Niagara Falls epidemic, in which 196 cases occurred in that town of 30,000 population. Disastrous epidemics have in several instances in recent years been started by the introduction of a single case. The disease is so contagious that improvements in general sanitation practically do not affect it.

Control depends upon *vaccination*, for isolation alone cannot practically be relied upon. Not only is smallpox extremely contagious, but "unrecognized cases . . . are so numerous that the isolation of the recognized cases often seems to be a complete failure" (Chapin). Such

[1] "Sources and Modes of Infection," 1910, p. 224.

mild or atypical cases may readily give rise to severe cases; hence their detection — so far as possible — is of great importance. Vaccination before exposure is a *nearly* perfect protection. This holds good also of vaccination up to the sixth or eighth day of incubation; and even at this time it may modify the course of the disease. Persons in any stage of the incubation period should be vaccinated, for the exact date of exposure may not be known, the incubation may be a prolonged one, and there is at any rate a chance of modifying if not of preventing entirely the development of the disease. Even when, as exceptionally occurs, the protection is not perfect and the disease is contracted, it is in the modified and milder form of varioloid. We refer, whenever vaccination is mentioned, to successful vaccination; a satisfactory "take" must be obtained, though two or more inoculations are required in some cases.

Objections to vaccination are based upon the arguments that it does not invariably protect and that blood infections have resulted from vaccinations with poor vaccine or improperly performed. While there is a small basis of fact in both the assertions, a glance at the benefits of vaccination is sufficient to show that these vastly outweigh the incidental drawbacks. Anti-vaccination argument may therefore stimulate care in the application of the process and accuracy in the statements of health officers, but is no valid objection, as world-wide experience proves. "In the Philippine Islands in the past few years the United States authorities vaccinated 3,515,000 persons without a single death or any serious post-vaccinal complications." [1]

The indicated administrative measures are as follows:

1. Registration of Cases. — This includes suspicious cases, and the health authorities should be prepared to furnish medical assistance in making diagnosis. Chicken-

[1] For a complete discussion of vaccination see Rosenau, "Preventive Medicine and Hygiene," 1913, p. 1 ff.

pox, on account of its resemblance to smallpox, should be a reportable disease, and in the presence of smallpox in the community physicians should be warned and suspicious cases of chickenpox should be medically inspected.[1]

Not infrequently cases of smallpox having no medical attendance come to light in public conveyances, lodging houses, and other places. Credible rumors of cases should be investigated.

2. ISOLATION, with disinfection of mouth and nose discharges, feces, and urine (do not, however, use carbolic acid or cresols), should be practised. Although isolation in smallpox is only of secondary value, it is of use in lessening the possibilities of infection, particularly when the cases are few. If a case of smallpox is introduced into a previously smallpox-free community, it is the duty of the health authorities to take prompt and stringent precautions in isolation and disinfection, as well as in vaccination of contacts as explained below.

[1] The *differential diagnosis* between smallpox on the one hand and chickenpox and other diseases on the other is important. Clinically, distinction is made primarily by the character of the eruption, and not by the constitutional symptoms, which may be absent or atypical. The smallpox eruption in the first stages is hard and "shotty" and extends into the true skin, while the chickenpox vesicles are superficial and easily broken. The eruption in chickenpox comes out in successive distinct crops (while that of smallpox never does), and there is comparatively little eruption of chickenpox on hands and feet. (See Doty, "Prevention of Infectious Diseases," 1911, p. 58 ff.) Differentiation may also be effected by inoculation of some of the virus (heated to 60° C. for 30 minutes) into the skin of a well-vaccinated person: if smallpox, a typical "immediate" reaction occurs, i.e., in less than 24 hours (see Rosenau, "Preventive Medicine and Hygiene," 1913, p. 17). Histological examination of the pock and inoculation upon the cornea of rabbits, are additional differential methods (see Rosenau, *ibid.*, pp. 280–281). When there is any doubt in the mind of the practitioner or health department physician, the case should be treated as if smallpox and expert diagnostic aid should be at once secured. In places where smallpox occurs infrequently the state health authorities should be notified by telegraph or telephone and their assistance requested.

Isolation should be of the strictest character. Unless home conditions are exceptional, the patient should be removed to a special hospital, which it may be necessary to establish in a vacant house or even in tents. Such a hospital need not, however, be the desolate "pest-house" of former days, but may be a special department of a regular contagious disease hospital. As already remarked, a smallpox hospital, if properly conducted, need not be located at a distance from other habitations. Fly transmission should be guarded against by proper screening. On account of the difficulties and expense of establishing proper emergency hospitals for smallpox, every community should have access to a ward or hospital always prepared, in connection with a municipal or county isolation hospital. Isolation should be permitted in a private house only if it can be perfectly maintained and a trained nurse is in attendance. Articles which may have been infected by the patient before or after isolation should be destroyed or thoroughly disinfected, and if he is removed to the hospital the apartment occupied by him should be disinfected. The precaution of terminal room disinfection after recovery should also be practised.

3. VACCINATION, as already remarked, is the measure upon which chief reliance is to be placed. Even the best isolation of cases cannot take its place. *All persons who have possibly been exposed to a case of smallpox should promptly be vaccinated.* Exception can only be made of persons who have had a positively successful vaccination but a short time previous. In nearly all cases vaccination will prevent the development of smallpox if taken promptly after exposure. Persons of intelligence may then be permitted to go without further official surveillance, though they should be advised to consult a physician if any symptoms appear within two weeks from last possible exposure (accepted for practical purposes as the maximum incubation period). Such persons will probably do so, being appre-

hensive; but if there is any question they should be kept under surveillance, being required to report to their own or the health department physician for medical examination each day for the period mentioned. Ignorant and careless persons should always be strictly required to submit to such surveillance. When a case of smallpox occurs in a crowded tenement, public building, or other place where there are many persons, every person who is suspected of having been at all exposed should be vaccinated, which may mean a very considerable number of persons.

The health authorities should constantly keep on hand *fresh vaccine virus* from a reliable source, and should be prepared to obtain larger quantities at short notice. Virus may now be obtained which produces a successful vaccination in nearly 100 per cent of previously unvaccinated persons, but it must be exchanged for fresh virus at certain intervals recommended by the manufacturer. Vaccine virus which enters into interstate commerce must come from a manufacturer licensed by the Federal authorities. Provision should be made for free vaccination of indigent persons.

The state authorities should be notified by telegraph of any case of smallpox appearing in a community, so that any needed coöperation may be obtained without delay. No pains or expense should be spared to stamp out the disease at the onset of the first case, a principle which also applies to other severe infections. If an epidemic threatens, a strong authority, centered in one person, should be established, and adequate emergency funds should at once be voted by the local government. It may be necessary to undertake a campaign for more or less general vaccination. An ample supply of vaccine should be promptly secured, and free vaccination offered and performed for persons unable to pay, and vaccinating physicians (especially engaged if necessary) should make a canvass in the infected neighborhood. In a serious epidemic school chil-

dren should certainly be vaccinated. Employees of hospitals, factories, workshops, hotels, etc., may require general vaccination. Cases should be removed to the isolation hospital, as has already been mentioned, so far as accommodations permit, but special emergency hospitals may be required. A diligent search should be made for concealed cases and for unrecognized cases; persons reported as having suspicious chickenpox should be medically examined.

What measures should the health authorities take at times when smallpox is not present? Since two successful vaccinations usually protect against smallpox for life,[1] the question is largely one of securing the vaccination of infants and school children. This is the vexed question of compulsory vaccination. The results of compulsory vaccination as practised in foreign countries (particularly in Germany, where it is compulsory for infants before the end of the first year of life and again at the twelfth year) indicate clearly the great benefits of the measure (Rosenau). In countries where it has been left merely optional, other conditions being comparable, the incidence of smallpox has been many times greater. If vaccination of the growing generation is neglected, there develops a large unvaccinated and non-immune population the numbers of which run a certain risk of coming in contact with unrecognized cases of the disease. The importation of such a case into such a community may readily start an epidemic more difficult to control than it would be if the whole population had at least a moderately good vaccinal status. While such facts indicate the desirability of vaccination of infants and children, and the Supreme Court of the United States and other courts have held such a requirement to that effect to be constitutionally valid, nevertheless there

[1] To secure complete immunity persons should be revaccinated on an average of every seven years. (Rosenau, "Preventive Medicine and Hygiene," 1913, pp. 15, 17.)

is considerable public sentiment, growing in intervals of absence of the disease, to the contrary.[1]

In some states the power to require vaccination of school children rests with the school authorities. The health authorities should favor such a measure. Some publicity may be desirable. In places where vaccination of children before admittance to school is required, there is likely to be considerable friction in enforcement unless a "conscience clause" in the law permits parents to exempt their children on the ground of personal objections. The least that can be done by health authorities is to inform the public as to the value of vaccination, supply reliable vaccine at cost (free to persons unable to pay), recommend the vaccination and revaccination of infants and children, and reserve the power to enforce vaccination so far as deemed necessary in the immediate infection area of each case that may appear.[2]

RABIES

"Rabies [hydrophobia] is an acute, specific, rapidly fatal infection communicated from a rabid animal to a susceptible animal, usually through a wound produced by biting. Man always contracts the disease from some lower animal, usually the dog." (Rosenau.)

Notwithstanding the fact that this dread but wholly preventable disease occurs in the United States, both in animals and in man, to an alarming extent, very little

[1] In Minnesota the state health authorities have acceded to popular clamor against vaccination laws and have even given up isolation in smallpox, maintaining that protection is purely an individual matter, the option lying with the person as to whether he does or does not care to protect himself by means of vaccination.

[2] The laws relative to vaccination in the United States are many and varied. In the majority of states its adoption is optional with the local health authorities. See "Vaccination: an Analysis of the Laws and Regulations Relating Thereto in Force in the United States," Public Health Bull. No. 52, U. S. Public Health Service, Washington, D. C., 1912.

control is exerted over it. This state of affairs is due to failure of health officials and public to realize the importance of the disease and to recognize it when it appears.

Transmission. — The virus exists in the saliva of infected animals (possibly 8 days before symptoms) and is usually transmitted to man through bites. The usual source is the dog, though other mammalian animals are suspectible to it and may both contract and transmit the infection. Among these are mentioned cats, wolves, foxes, skunks, cattle, sheep, goats, horses, and swine. But inasmuch as infection under ordinary circumstances is from the dog we shall confine our discussion largely to that source.[1]

Infection is not necessarily by biting, — the mere licking of the bare hand or face by a rabid animal may result in infection if cuts or abrasions exist. Even where such breaks in the skin are not visible to the eye, infection is possible. Hence the rule is to handle any sick dog with thick gloves and to protect one's face, until positive that the sickness is not rabies. Bites through the clothing may result in infection, though not so readily as those on the unprotected parts of the body. Bites upon the face are particularly dangerous, for the virus has there quicker access to the nervous system, which is its object of attack. Infection may take place in dissections of the bodies of animals which have died of the disease, the virus existing in the nervous system.

The incubation period of rabies in man is 40 days on the average, but varies from 14 days to a year or more (Rosenau). In dogs the average is 21 to 40 days. This long period is fortunate for preventive treatment, but unfortunate in that it diverts popular attention from the disease between occurrences and makes general measures of pre-

[1] Wherever in this section the word "animal" is used it is meant to apply chiefly to dogs. The measures recommended for control of rabies in dogs may be adapted to apply when necessary to rabies in other animals.

vention more difficult to enforce. A dog runs through a town and bites a number of persons and dogs; there is an excitement which soon dies out. In the course of several months some more dogs develop rabies, — again some excitement, several dogs are killed, and then again the matter is forgotten. In the long run a grave problem is much under-rated simply because the cases are so distributed.

INCIDENCE. — Rabies may develop in any person bitten by a rabid animal (unless the Pasteur treatment is given — see below), and if it does develop is invariably fatal. It occurs to an absolutely unwarranted extent in the United States: in 1911 there were 1381 localities in which rabid animals were reported and 98 deaths in man (Rosenau), and it is apparently on the increase in many regions. Rabies undoubtedly occurs to a greater extent than is shown by the figures, for there may be failure to rightly diagnose sporadic cases. Some deaths from rabies have probably been ascribed to cerebrospinal fever and other diseases. For example, a patient taken to a hospital with slight temperature and pain becomes violent and dies in a few hours. No diagnosis, and on autopsy nothing found except congestion of the brain. The suggestion of rabies is made. Animal inoculations are made and prove the case one of rabies. It is a great chance in such cases that the disease goes unrecognized. With children symptoms may be even more puzzling. Young children may be slightly bitten by rabid dogs without the knowledge of the parents. And frequently the dog-bite which caused the infection happened so many weeks before that it has been entirely forgotten.

Moreover, to the actual mortality from an agonizing and unnecessary form of death must be added the time and money incident to taking the Pasteur treatment in hundreds of cases, and the grave anxiety involved.

Such facts indicate the gravity of the rabies problem.

Rabies occurs at all seasons, though the popular idea that rabies is a hot-weather disease is true in that dogs run more freely at large in the summer season and thus incur and transmit infection more readily. Distemper, which is sometimes popularly confused with rabies, is also perhaps more prevalent in hot weather.

Recognition of Canine Rabies. — The symptoms of the disease in dogs are sketched in the information given on page 224 (footnote), and should be recognized by all persons having charge of dogs, as well as by health officers and inspectors.

Dogs suffering with rabies may not by any means show all the text-book symptoms, nor do they always behave as the popular idea of a mad dog would lead one to expect. They do not fear water (though paralysis of the throat muscles in the late stages of the disease may hinder them from drinking it); hence the term hydrophobia, signifying "fear of water," is incorrect. The one unfailing symptom is the paralysis which, beginning with the hind-legs, invariably develops before death.

In the *furious type* of rabies the animal is highly restless and has a tendency to run long distances biting any persons and other animals in his way. This is the popularly recognized mad dog. But in the *dumb type* of the disease the animal is quiet and depressed and does not show the same tendency to wander and bite, though if a wound is received from this type it is as dangerous as from the other. The following account, by a physician, is illustrative:

A man came to my office some years ago with a small punctate wound of the face. He stated that he had been called by one of his neighbors to shoot a sick dog. In pulling the dog out of the kennel he received a wound, he did not know whether from a tooth or from the dog's paw. I asked him to describe the dog's condition, and he made the following statement. The dog had been sick for several days, refusing to eat, and remaining in his kennel. He also stated that the dog had a broken jaw and could not close his mouth; the tongue was quite black.

> This man died five weeks later a horrible death from hydrophobia. Had I then known that the supposed broken jaw was the paralysis of this [dumb] form of rabies my patient might have received the Pasteur treatment, and not have been a victim of this disease.

And, it might have been added, if the owner of the dog had had some conception of the symptoms of rabies the proper care might have been taken and the infection might thus have been entirely avoided.

DIAGNOSIS. — Diagnosis on the symptoms is uncertain and should be confirmed by laboratory methods. The first of these is the microscopic examination of the brain substance for the presence of the "Negri bodies." The finding of these bodies shows at once the existence of rabies. Failure to find them does not, however, necessarily signify that the animal did not have rabies, for they may miss detection. If the Negri bodies are not found it is necessary to make animal inoculations, which are the most reliable test, but generally several weeks will be required for the disease, if present, to develop in the test animals.

If a dog is suspected of rabies it should not be killed (unless safety requires) but should be securely chained (a rope may be chewed through) within an enclosure which will exclude all persons and other animals. If suffering from rabies, the dog will develop paralysis and die, usually in four or five days. If, on the contrary, the dog is alive and sound at the end of ten days, it may then be released without danger.

If necessary to kill the animal, the brains should not be blown out, but the head should be kept as nearly intact as possible. The carcass (if the dog is large, the head only) is then packed in ice in a watertight container and forwarded by rush service to a laboratory for the examinations which have already been described. The head should be severed as close to the thorax as possible, with sharp instruments (knife and saw). In order to avoid infection the operator should protect the skin of the hands with thick

gloves and exercise cleanliness followed by disinfection of gloves, implements, and hands. The carcass after severance of head should be burned or deeply buried.

Prevention. — Eradication, prompt and practically absolute, will result from drastic measures relating to the control of dogs. In England and Australia, owing to such measures, rabies is now non-existent. The use of Pasteur preventive treatment is of the greatest importance in personal prophylaxis, but has nothing to do with the proper eradication of the disease.

We shall speak first of the *general measures* which should be taken by health authorities.

1. Muzzling and Quarantine. — The most immediately effectual measure is to require the muzzling of all dogs at large and the killing of all ownerless dogs. Such measures must be strictly and universally enforced over a wide area, such as the state, and there must be active dog-wardens to capture the stray and ownerless dogs and dogs whose owners allow them out without a muzzle. Such measures, in conjunction with a national quarantine of six months against dogs entering the country, has freed England entirely from rabies in dog or man. Two years of such a régime will practically exterminate the disease, and then, unless it reappears, the muzzling (but not the quarantine) may be discontinued.[1]

Leashing as a requirement has been sometimes tried, but appears not to be entirely effective.

The above measures of general muzzling for a certain period and a national quarantine are undoubtedly the most radical and effective. They require, however, *a general law generally enforced.* Strong state laws (cf. page 231) should be adopted and should ultimately lead to such complete control. Meanwhile measures of the following classes will afford a certain degree of *local* protection.

[1] For further information see Rosenau, "Preventive Medicine and Hygiene," 1913, p. 36 ff.

2. Registration of Dogs. — It is essential that all dogs be registered (licensed). The registration should be controlled by the health authorities as a fundamental step in the prevention of rabies. Inasmuch as dogs constitute the principal reservoir of rabies infection, this consideration should outweigh all others, and the health authorities should be vested with this means toward the suppression of a disease which falls in the regular category of communicable diseases. Registration should not be entrusted to humane societies or other unofficial bodies.

Registration is not merely an indexing of the canine population, it is more especially for the purpose of fixing a certain responsibility upon the owners of dogs. The fee charged should not be so high as to make the keeping of a dog a luxury, but should be high enough to ensure a distinct interest on the part of the owner and to discourage the keeping of dogs by irresponsible persons. Registration has a special value in that it enables the health authorities to reach the owners with educational measures (see below).

Registered dogs should be tagged with a tag distinctive for each year, and *all untagged dogs* on the streets should be taken up by a vigilant dog warden, to be *destroyed* if not claimed and registered. Upon this depends the whole operation of the law, the greatest value of which lies in doing away with stray and ownerless dogs. It is just this last class of animals which, wandering about and picking up and distributing any rabies infection which may exist, is most dangerous.

3. Instruction of Dog-Owners. — Every person registering a dog should receive printed information (preferably printed on the license receipt so as to be kept for reference), to be explained orally if necessary, giving (1) the ordinances relative to the keeping of dogs (see page 229), and (2) the symptoms of rabies.[1] It is a fact that scarcely any of the

[1] The following form, headed "RABIES," may be used:

"Rabies is an infectious disease which may attack dogs, cats, and other warm-blooded animals and which may be communicated to

persons responsible for the care of dogs are acquainted with the symptoms — especially the early symptoms — of the

human beings, in whom it is usually called *hydrophobia.* It may occur at any season, winter as well as summer.

"The onset of rabies in the dog is sometimes unrecognized by its owner as there are considerable variations in the symptoms, and many of the cases do not show the violent symptoms popularly associated with the 'mad dog.' It should be remembered that rabies makes the dog sick and causes him to *act strangely*, dying within a few days — usually four or five.

"*Two forms of the disease commonly occur: the quiet or dumb form, and the active or violent form.* In the first the dog is *depressed* and drowsy and shows little or no tendency to bite or run away. The lower jaw is slightly dropped, and although the animal laps liquids freely he is unable to swallow them. He may be thought to have 'a bone in his throat' because he does not care to eat. Weakness of the hind legs sets in, and the animal dies within a few days.

"In the second form the animal is *restless*, sometimes irritable, and sometimes unusually affectionate (in the onset). The voice is changed to a peculiar howl. Frequently the dog runs away from home. Later, weakness of the legs sets in, and death follows within a few days. Some cases show symptoms belonging to both these classes. *It is important to remember* that mad dogs show no fear of water and are able to eat and drink until paralysis of the throat sets in. This is sometimes early in the disease, as in the dumb form. In other cases it may not occur until just before death.

"It should be remembered also that the secretions from the mouth of the rabid dog are poisonous whether he shows any tendency to bite or not.

"The only safe rule to follow is to be careful in handling any sick dog until absolutely sure that he has not rabies, to wear heavy gloves in handling such a dog, and to avoid the secretion from the mouth.

"In case of infection from the saliva of a dog suspected of rabies, the wound should be washed out at once and a physician consulted as soon as possible.

"If a dog is sick with an unknown disease or is suspected of being rabid he should be securely chained (if this can be done without undue risk) and the Board of Health notified. If a dog suspected of being rabid is running wild and biting persons he should be killed as quickly as possible and the carcass held for examination by the Board of Health." (Adapted from form used in Orange, N. J.)

The Massachusetts law prescribes that "every license issued to the owner of a dog shall have a description of the symptoms of hydrophobia printed thereon," such description to be supplied to the local authorities by the state health department.

disease, and inculcation of such knowledge would prevent many if not most of the cases of bites by rabid animals.

4. Legal Responsibility of Dog-Owners. — The owners of dogs should be made legally and explicitly responsible for any and all damage inflicted by their dogs.[1] This would include the cost of the Pasteur treatment taken by persons bitten by a rabid or supposedly rabid dog.

The measures to be taken by the health authorities in *specific cases* are as follows:

1. Reporting of Dog-Bites. — Every case of a person bitten by a dog should be reported to the local health office by any person having cognizance of the fact. This would apply particularly to physicians called upon to treat wounds,[2] and to the police, who are frequently appealed to in such cases. The majority of persons bitten are children, and there is danger that some of these cases will go unreported unless public attention is called to the necessity of reporting even minor bites by animals. The health authorities should locate the dog, order it (if possible without danger to persons) to be secured with a chain (not a rope, which may be chewed through by the animal) or penned up, and kept from the access of children and other persons for ten days. In some instances it may be advisable to remove the animal to the pound or some other place where a good surveillance can be maintained. Careful inquiry should be made to obtain the names and addresses of all

[1] Such a law has been adopted in Ohio. See note, p. 232.

[2] " Wounds produced by the bite of an animal in which there is any suspicion of rabies should at once be cauterized with fuming nitric-acid. The acid is best applied with a glass rod very thoroughly to all parts of the wound, care being taken that pockets and recesses do not escape. Thorough cauterization at once reduces the danger of wound complications, and experience demonstrates that wounds so treated at once, are practically never followed by rabies. . . . In the absence of nitric-acid the actual cautery may be used. . . . In any wound produced by the bite of an animal the rule is to cauterize unless sure that the animal is not mad." (Rosenau, " Preventive Medicine and Hygiene," 1913, p. 40 f.)

persons who may have been bitten. The dog should not be killed unless necessary for safety.

If it is necessary to kill the dog, or if it dies while under observation, the carcass or head must be sent to the *laboratory* for examination (see page 222). A great many cases of dog-bite occur in which the animal is not rabid, but the above precautions should always be taken if any persons have been bitten.

Dogs, not rabid, which are so vicious as to be unsafe at large should be dealt with by police regulations requiring them to be penned up or chained.

If the animal lives until the expiration of the surveillance period, no further action need be taken.

But if a positive diagnosis of rabies is made or if the animal dies or is killed with suspicious symptoms (even if the laboratory test[1] turns out negative), then immediate action is to be taken as follows:

(*a*) *The persons who have been bitten* should take the Pasteur preventive treatment.[2] Great pains should be taken to locate all persons who have been bitten by the animal and to obtain an exact account of the circumstances in the various cases. (If the animal has run in from another community the health officer of that community should be notified.) It is the duty of the health officer to urge the treatment in all positive cases and advise it in all doubtful ones. If the person has not been actually bitten but has had the face or hands licked by a dog which subsequently was proved rabid, he may be told that the danger is slight but that to be on the safe side the treatment may be taken. On the other hand, there is trouble and expense (as well as a slight danger of paralysis as a complication) connected

[1] Reference is to the examination for Negri bodies, which can be made without delay. Animal inoculations take longer. See p. 222.

[2] The treatment is generally furnished by state and large municipal laboratories, and by several commercial manufacturers. The doses may be sent to a distance and administered by a local physician.

with Pasteur treatment and it should therefore not be advised indiscriminately.

The treatment reduces the mortality in persons bitten by rabid dogs to 0.5 per cent or less. Since immunity can be produced by the Pasteur treatment within a considerably shorter time than the incubation period of rabies, it is evident that if the treatment is started early it is a highly effective measure of protection.

The question of *expense* not infrequently arises. Poor persons are unable to pay the cost of the treatment, and cases are not unknown where lives have been lost through omission on this account. There should be no hesitation whatever in so serious a matter. Provision should be made by law that the expenses of treatment for persons unable to pay should be paid out of the community poor funds. Delay and red tape should be obviated so that no person need hesitate on account of the expense or the question who is to defray it. The owner of the rabid animal should ultimately be liable for such expenses, which may be recovered later, *after* the treatment has been begun.

(*b*) *The animals which have been bitten* (or are suspected of having been bitten) should be killed by the owner at the direction of the health officer. (It is assumed that care has been taken to get a complete list of such animals.) Most owners can be persuaded to destroy their dogs if they are told that there is a strong possibility of rabies developing. Valuable animals may as an alternative be kept under strict surveillance, confined and subject to inspection by the health authorities for six months. Such confinement requires the animal to be secured with a metal chain or to be kept in a secure pen away from access of persons. The owner must immediately report any unusual behavior or symptoms of the dog, and if it develops rabies it must at once be destroyed and the kennel or pen disinfected. Such quarantines are usually difficult to keep, for the animal becomes restive and may be surreptitiously

taken out for an airing. They should only be resorted to exceptionally; there should be careful oversight and any infringement should be at once prosecuted. It is desirable that the health authorities have power conferred by law to kill such animals if the quarantine be not satisfactorily kept.

The coöperation of the police must be secured, for upon them the health authorities must rely for a great deal of information and support.

2. Rabies (or Suspected Rabies) in Animals to be Reported. — This requirement applies particularly to dogs. Every person having custody of a dog should report at once to the health authorities any suspicious symptoms (see sec. 1 of the ordinance in footnote below). Through effective education of dog-owners it should be possible to enforce such a requirement. An inspector may see the animal and if necessary call in a veterinarian or take other steps to establish a diagnosis (see page 222). If no persons have been bitten and the symptoms are very suspicious of rabies the animal should be killed. The carcass should be disposed of with care, and the kennel or pen should be destroyed or disinfected. The steps to be taken when persons or other animals have been bitten have already been described.[1]

[1] The following may serve as an example of an ordinance covering most of the points mentioned in these two sections. Such provisions, as will be explained presently, should be enacted in *state law*.

"1. Whenever the owner or person having the custody or possession of any animal shall observe or learn that such animal has shown symptoms of rabies, or has acted in a manner which would lead a reasonable man to a suspicion that it might have rabies, such owner or person having the custody or possession of such animal shall immediately notify the Board of Health or the Health Officer, and shall allow the Health Officer or other official of the Board of Health to make an inspection or examination of such animal, and to quarantine such animal until it shall be established to the satisfaction of said official that such animal has or has not rabies.

"2. Whenever it is shown that any dog has bitten any person, the owner or person having the custody or possession thereof shall,

Needless to say, reporting of rabies in human subjects should be required.

3. Power to Declare Quarantine. — Where an epizoötic outbreak of rabies exists or threatens, the local health authorities should have the power to declare a quarantine of dogs in the district under its jurisdiction. Such quarantine may require restriction of dogs to premises, or leashing or muzzling. It must be strictly enforced by alert inspectors or dog-wardens, with the power to take up the dogs in cases where the order is not complied with and to hold them until a fine is paid or to destroy them if not claimed. While quarantines are frequently a matter for areas larger than local municipalities, such local quarantines have a certain value.

upon order of the Health Officer, quarantine it and keep it tied up or confined for a period of two weeks [10 days sufficient — Author] and shall allow the Health Officer or other official of the Board of Health to make an inspection or examination thereof at any time during said period.

"3. If it shall appear to the Health Officer or other official of the Board of Health upon examination as aforesaid, or otherwise that a dog or other animal has rabies, he may kill it forthwith.

"4. Whenever any animal shall be bitten by another animal having rabies, the owner or person having the custody or possession of the animal so bitten shall, upon being informed thereof, either kill such animal or quarantine it and keep it tied up or confined for a period of six months, and the Health Officer or other official of the Board of Health shall have power, in his discretion, to kill or quarantine the animal so bitten, in case the owner or person having the custody or possession thereof shall fail to do so immediately, or in case the owner or person having the custody thereof is not readily accessible.

"5. Any person violating any one of the provisions of this ordinance shall forfeit and pay a penalty of twenty-five dollars for each offence." (Ordinance of Orange, N. J., Board of Health.)

(Note that the general term "animal" is used in secs. 1, 3, and 4. Laws should be so worded in order that measures usually applicable to rabies in dogs may by extension be applied to the occasional occurrence of rabies in other animals.)

Other provisions, e.g., power to declare quarantine, etc., as suggested in the discussion, should be incorporated in state or local law.

The question of the control of simply vicious dogs is related to public safety rather than public health and cannot be taken up here. It may be dealt with by police ordinances.

Necessity for State-wide Control. — Notwithstanding that a local health department may wield all the powers mentioned above, the rabies problem is by no means entirely solved. It is a matter demanding also *state and federal control.* The reason for this is that, no matter how strictly local regulations may be enforced, a single community is always at the mercy of the rabid dogs which may enter it from neighboring communities. Rabies occurs very frequently in the wandering dog — the stray without care or restraint. Such dogs, driven by the restlessness or frenzy characteristic of the disease, frequently travel many miles. In their journey they may pass through several towns, biting and infecting persons and animals as they go. Every health officer of experience knows that this is not an uncommon experience. Sometimes children are "nipped" by such an animal, which then disappears; and the incident is lightly passed over and forgotten until, several weeks later, cases of rabies develop in human subjects and dogs. The dangers are too obvious to require elaboration. The question is, how can a community protect itself from such occurrences? We are forced to answer, it cannot. There should be general enforcement of uniform law throughout the state, state authorities should have power to declare regional quarantines and other measures, and all states should coöperate in action.[1]

[1] Several states have now some measure of control. "Massachusetts has an admirable law. Every city and town is required by law to have an inspector of animals who is responsible to the State Cattle Bureau, and who has, as one of his duties, the killing or quarantining of animals exposed to rabies. As a result of this law there has been a remarkable decrease in rabies during the past year. . . . New York has a law which gives the right to the State to enforce quarantine and muzzling of dogs where necessary. . . . Pennsylvania has a

Ultimately there should be federal quarantine restrictions on the importation of dogs, which, combined with muzzling until rabies shall have disappeared, would completely extirpate the disease (see page 223).

State legislation should cover the whole subject in detail and might well embody the following points, as a summary of what has been said: (1) Registration (licensing) of all dogs, (2) Information to dog owners, (3) Legal responsibility of dog owners, (4) Free treatment of indigent persons bitten by rabid animals, (5) Reporting of all dog-bites, (6) Reporting of rabies or suspected rabies in beast or man, (7) Surveillance of animals, local or district quarantine, muzzling, etc., under control of local or state authorities, as circumstances may require. Some of these provisions would be left to local authorities for execution, with power of supervision by state authorities and of intervention by them in case local action is inadequate.

similar law, and also provides a fund for reimbursing persons whose cattle, horses, sheep, or swine may be killed by reason of their having been bitten by rabid dogs. Pennsylvania also provides free treatment for all persons exposed to rabies from any animal at the expense of the poor district of the county. . . . In Ohio, dog owners are liable for damages done by their dogs. County commissioners may pay the whole or part of the expenses incurred by a person in undergoing treatment for the bite of a rabid animal. . . . District of Columbia has a general muzzling law of all dogs, which went into effect August 11, 1910. This ordinance has just been renewed for another year. The effect of the general muzzling law has caused a marked reduction in the number of cases of rabies." (Hallett, F. S., " Rabies: Its Prevention and Control," *Proceedings of Third Annual Conference of State and Local Boards of Health of New Jersey*, 1912.) In Connecticut cases of animal rabies are reported by health officers to the State Commissioner on Domestic Animals, who has authority to take charge of the situation and make any necessary regulations concerning dogs. An Act of 1909 also provides that when a licensed physician certifies to the selectmen of the town in which the injury was received that Pasteur treatment is necessary, they shall bear the expense of such treatment.

In conclusion it may be said that, in the adoption of provisions for the control of rabies, health authorities will meet with a good deal of well-intentioned but erroneous opposition on the part of "dog-lovers." Such opposition may be met with tact in stating that rabies cannot be stamped out except by strict measures of control extending over some years and that the safety of man outweighs restrictions on the comfort of the animal. Furthermore, the suppression of rabies benefits the animals themselves and results in a considerable saving in live-stock. A well-informed general public opinion, both of those who own dogs and of those who do not, should support effective measures for the control of this dread but wholly preventable disease.

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VENEREAL DISEASE

The venereal diseases are now considered as one of the major problems in communicable disease. But thus far the steps made toward treating venereal disease as a public health problem have been limited, the reason being that it is so deeply rooted in private life and so closely interwoven with the passions and morals of the individual. The fact that knowledge of the modes and chances of infection fails to deter many persons from exposure to the risk of contracting these loathsome diseases indicates the force behind their propagation.

The two chief diseases under this head are *syphilis* (cause: a protozoön, the *Treponema pallidum*) and *gonor-*

rhœa (cause: the *Gonococcus*). To these we may add, as secondary, though important, chancroid.

Transmission. — While venereal transmission of these diseases is the common mode, transmission also takes place by other modes of contact. Thus syphilis may be transmitted through kissing and by towels, cups, eating utensils, barbers' implements and other objects, in such manner that the mucous membrane of the mouth, lips, etc., or skin abrasions, become infected. Again, gonorrhœa, especially in the form of gonorrhœal inflammation of the eye, is communicable by means of infected towels, toilet fixtures, etc. Thus innocent persons contract the infections more frequently than is commonly supposed. The largest class of the innocently infected consists of women who are infected by their husbands. It has been stated that the greater part of the cases in the practice of gynecology, including operations for diseases of the female genital system, are the result of gonorrheal infection. Still another manifestation of gonorrhœal infection is gonorrhœal ophthalmia neonatorum (see below, "Preventable Blindness"). Altogether, gonorrhœa, while popularly regarded as a trivial infection, "is one of the serious infectious diseases, and the gonococcus occupies a position of high rank among the virulent pathogenic microörganisms. From an economic and public health standpoint, gonorrhœa does not fall very far short of syphilis in importance; in fact, some give it the first place." (Rosenau.)

The prophylaxis to be observed by the patient includes not only abstention from venereal transmission, but also measures to avoid contact infection of innocent persons by the means already suggested. Such measures include personal cleanliness, careful washing and disinfection of the hands, the use of individual towels, cups, glasses, etc., as long as there are discharges or open lesions. The cleanliness and disinfection of privy and water-closet seats and other toilet fixtures should be looked after.

Incidence. — Reliable statistics of venereal disease are at the present time scanty, and estimates should be taken with caution. Even the deaths are rarely ascribed primarily to syphilis or gonorrhœa, but to some terminal condition, which is either the only thing the physician perceives or the only thing considered sufficiently euphemistic to inscribe on a public record of death. However, the direct mortality is not the only, nor the worst, effect of these diseases; most of the damage is insidious, elusive and indirect.

In the absence of public statistics we turn to hospital and medical records, the revelations of which can, however, be only briefly alluded to here. The end-results of syphilis in the patient may be general paresis, arteriosclerosis, locomotor ataxia, aneurysm, etc. The disease also tends strongly to produce susceptibility to tuberculosis and other infections and diseases. The effect on the offspring may be even more severe. To hereditary syphilis are due many deaths of infants put down to congenital malformation, congenital debility, and the like; while infants who survive are blighted with various impairments and affections. Gonorrhœa is remarkable for the multiplicity of its forms of infection and for its long persistence. Gonorrhœal arthritis and sterility are among the more serious developments. Its effects in the female system have already been alluded to. The thorough cure of gonorrhœa is a difficult matter; the infection may persist for years. In children's hospitals gonorrhœal infection may become epidemic, constituting an obstinate problem.

Control. — From the sanitary standpoint the venereal diseases should be subject to the same sort of control as other serious communicable diseases which require certain restrictions to be laid on the infectious person. Practically, however, the connection of the diseases with the deeply rooted "social evil" and its intrenchment behind the walls of private life have stood as an obstacle to the adminis-

trative measures which would otherwise be taken. We shall briefly outline the measures thus far proposed. It scarcely need be said that health authorities can only undertake to deal with the purely sanitary features of the problem.

1. Registration of Cases. — The logical first step is to obtain knowledge of the problem through reports from physicians. Voluntary reporting alone will not accomplish much, but procedure may be taken, as has been done in New York City, by progressive steps: first, voluntary reporting by physicians of their private cases, with the understanding that the data are merely to gain knowledge of prevalence, and obligatory reporting of cases treated in hospitals and dispensaries; eventually, obligatory reporting of all cases.[1] As a concession to privacy, the reports may — at first, at any rate — be made under numbers indicated by the physicians instead of by name. There are indications that eventually a complete registration of the venereal diseases may be built up.

2. Laboratory Diagnosis. — It is highly important that the health department afford laboratory diagnosis. The following tests are available: for syphilis, the Wassermann serum reaction and the microscopic examination for the treponema; for gonorrhœa, the complement fixation test and the microscopic examination for the gonococcus. Such examinations should at least be made free of charge by state laboratories as they are now made in several of the larger cities, on condition that full information (including name) of the case be furnished by the physician.

[1] In Montclair, N. J., hospitals, dispensaries and other institutions are required to report cases of venereal disease within twelve hours, and private physicians are requested to do so. Information is confidential and records are not open to the public. The health department makes free laboratory tests for diagnosis, requires treatment (alternative, isolation), and provides treatment free of charge for indigent cases. Venereal diseases are also reportable in California, Michigan and Vermont.

3. Supervision of Cases. — When a registration of cases has been secured it is the next logical step to insure as far as practicable that each case is prevented from extending infection. The chief object is to prevent the infection of innocent persons in the ways which have already been mentioned.

For cases under the care of a *private physician* the instruction of the patient as to the dangers of spreading the infection and the precautions to be observed should be attended to by the physician. It is evident that the control over private cases must be secured through the physician and with his coöperation. The emphasis in treatment, from the public health standpoint, should be placed upon freeing the patient from infection as well as merely abating painful symptoms. Many cases unfortunately leave the physician's care before that end is attained, and, while control of them is lost, remain sources of infection.

In regard to *hospitals and dispensaries*, efforts should be made to increase the facilities for treatment. *Such treatment,* from the standpoint of the sanitary authorities, *should be directed toward rendering the patient non-infectious.* Many patients obtain the cheapest possible medical treatment and leave off as soon as acute symptoms subside, but while they are still infective. Again, other cases, self-treated, never see a doctor. Thus there is a class of persons who, apparently healthy but really dangerous, are virtually carriers of venereal disease. There should be some way of securing the continued treatment of such until they are completely cured and non-infective. Many hospitals refuse patients with acute venereal disease, yet the public health requires adequate hospital treatment. Genito-urinary clinics are needed in places where they do not now exist. The aim of the health authorities should be eventually to enforce the treatment of all venereal cases — private, dispensary, and hospital — until they are rendered non-infective, and to keep them until that time

under supervision with the requirement of prophylactic measures for the protection of other persons.[1]

It may be added that the measure of regulating prostitution through medical inspection and licensing of prostitutes, which has frequently been tried in European cities, has been largely abandoned; partly because it tends to defeat its own object by making vice safer and partly because it involves an official recognition and condoning of vice, but chiefly because it does not reach — but rather increases — the clandestine prostitution which is the greatest source of venereal disease. Even where such regulation is practiced, medical inspection is far from being a complete safeguard.

Other proposals need not be considered here. Some, such as the formal teaching of so-called sex hygiene, may be condemned on moral as well as practical grounds. The same may be said of publicity on this class of subjects.

In fine, it may be said that the control of venereal disease — the "black plague" — while a public health problem, is also — and fundamentally — a social and moral problem closely interwoven with alcoholism and other evils. There is at the present time a movement against the social evil, which has given rise to many unsound proposals, as well as to some good ones, — a situation which calls for careful discrimination.

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Bolduan, "Venereal Diseases — The Relation of the Public Health Authorities to their Control," *Am. Jour. Pub. Health*, 1913, vol. III, no. 10, p. 1087.

Reports of Committee of American Public Health Association.

[1] The Board of Health of Montclair, N. J., has recently adopted the following regulation:

"Every person residing in or working in the Town of Montclair who is found to be affected with a venereal disease shall immediately take proper treatment for the cure of such disease, or be isolated."

PREVENTABLE BLINDNESS

OPHTHALMIA NEONATORUM

Ophthalmia neonatorum is a term covering all inflammations of the eyes of newborn infants. Such inflammations are accompanied by more or less discharge and destruction of tissue and may cause permanent and needless blindness. In this, gonorrhœal infection at time of birth is the largest single factor. There are also other causes of preventable blindness — e.g., various infections, trachoma, poisonings (wood alcohol, excessive use of alcohol or tobacco, lead, etc.), accidental injuries, etc. — but the following discussion will be limited to the chief preventable cause: ophthalmia neonatorum. A few remarks will also be devoted to trachoma.

There are 64,000 registered blind persons in the United States. Of these about 10 per cent (between six and seven thousand) are blind as the result of ophthalmia neonatorum. From 25 to 30 per cent of all the blind children in all the blind schools of this country owe their affliction to gonorrhœa. It has been estimated that probably one-half of the blindness in the world is preventable.[1]

There are no complete statistics on ophthalmia neonatorum. It has, however, been ascertained through figures collected from physicians that it may occur in eleven cases per thousand births.[2]

Transmission. — Ophthalmia neonatorum at time of birth is usually a gonorrhœal infection contracted from the mother. Gonorrhœal and other infection after birth may also take place through contact of infected hands, towels, etc. If such infections are permitted to develop and continue the eyesight is always menaced and frequently destroyed.

[1] Rosenau, " Preventive Medicine and Hygiene," 1913, p. 60.

[2] Monograph Series of the Am. Assn. for Conservation of Vision, vol. I, no. 1.

Control. — Ophthalmia neonatorum is absolutely and entirely preventable. The principle of control is to disinfect the eyes of all newborn infants by appropriate prophylactic treatment. Even if the inflammation has developed it may be checked by proper treatment.

The following administrative measures should be adopted:

1. Prophylactic Treatment of Eyes of the Newborn. — The law should provide that at time of birth the eyes of all newborn infants be treated with prophylactic solution. The physician and midwife should be relieved of the uncertainty and responsibility of deciding whether or not the treatment is necessary in any given case by being required to apply it in *all* cases.

The treatment usually recommended is an application of silver nitrate solution according to the Credé method.[1]

Health authorities should distribute without charge to physicians and midwives *small outfits of silver nitrate solution* with a glass rod or dropper and printed instructions.[2]

[1] This consists in dropping into each eye of the newborn infant immediately after labor a drop of a 1 per cent solution of silver nitrate, in such manner that the solution comes in contact for one-half minute or longer with every portion of the conjunctival sac. Credé's original method called for a 2 per cent solution, but this is apt to be irritating and the 1 per cent solution for routine use appears to afford adequate prophylaxis. Other silver compounds, such as argyrol (20 to 25 per cent), protargol (5 to 10 per cent), or sophol (5 per cent), are said to be as effective as silver nitrate and less irritating. A second application should never be made during the following twenty-four or thirty-six hours, even if slight redness and swelling of the eyelids with mucous secretion should follow the first application; repeated applications may cause serious inflammation (" silver catarrh ").

The solution is kept in a dark-colored vial with ground glass stopper, having a neck about half an inch in diameter. For the dropping may be used a dropper and bulb or a glass rod about six inches long and very smooth and round at each end. The silver solution will keep for many months, but it is best to renew it about once in six weeks. Outfits should be stored in a dark, cool place.

[2] Such prophylactic outfits, together with a circular of instruction in detail, are issued to physicians by the health authorities of Massachusetts, New Jersey, Vermont, Rhode Island, New York, District of Columbia, and other states.

Midwives require careful instruction, in most cases oral, and should be supervised to see that they carry out the routine prophylaxis properly.

2. Reporting of Eye Inflammation in Infants. — All cases of inflammation of the eyes of the newborn appearing within one month after birth should be required to be reported to the health officer by physicians and midwives. This requirement enables the health authorities to ascertain the extent of the disease and also to ensure proper treatment of all cases. If the case is under the care of a regular physician, no further steps need be taken unless further information is desired. But if it is not known that this is the fact, the case should at once be looked up to ascertain the nature of the infection and what treatment, if any, is being applied. Cases are sometimes reported by midwives in families too poor to engage a physician; such cases may properly be referred at once to the town poor physician, who may be assisted by the district nursing association if nurse's services are required in the treatment.

Diagnosis of the conjunctivitis should be made without delay, by microscopic examination of a stained smear of the discharge. Such examination may be made by the health department bacteriologist. The following advice for treatment according to the bacteriological diagnosis is given by Rosenau:

> If the inflammation is due to the gonococcus, a 2 per cent silver nitrate solution should be used. In certain mild, non-gonorrhœal infection 0.5 per cent is usually sufficient. If the Klebs-Loeffler bacillus is found, diphtheria antitoxin should be given without delay. If the diplococcus is present, a weak solution (1 grain to the ounce) of zinc sulphate should be instilled frequently.[1]

State Legislation. — State legislation is highly desirable.[2] While the aggregate number of cases constitutes

[1] "Preventive Medicine and Hygiene," 1913, p. 64.

[2] The following provisions of the New Jersey law (as amended in 1910) may serve as an example of the character of such legislation:

a serious problem, the number occurring in any one local community may escape observation, with the result that measures of control are neglected.

Auxiliary Measures. — The radical, but not the most direct and practicable, means of eliminating ophthalmia neonatorum is the suppression of gonorrhœa as a venereal disease (q.v.). The education of ignorant midwives in their duties regarding this disease (as well as in the general technique of their profession) is frequently a grave need. Finally, the prompt reporting of births, permitting an infant hygiene nurse to see infants shortly after birth, is essential.

TRACHOMA

Trachoma is an infectious granulation of the eyelids, communicable by contact. It is a chronic progressive

1. "That should one or both eyes of an infant become inflamed, swollen or reddened, or show any unnatural discharge at any time within two weeks after its birth, and no legally-qualified practitioner of medicine be in attendance upon the infant at the time, it shall be the duty of the midwife, nurse, attendant, or relative having charge of such infant to report the fact in writing within six hours, to the local board of health. . . . "

2. Local board of health to direct parents or persons having charge of such infant to place it immediately in charge of a legally qualified physician or (in indigent cases) of the town physician. (In Massachusetts the board of health "shall take such immediate action as it may deem necessary.")

3. Copies of law to be printed by State health authorities and supplied to local boards of health, the latter to distribute a copy to every physician, midwife, and nurse in their several districts.

4. Penalty, $50. (Provision should also be made for imprisonment in case fine is not paid.)

5. Date to take effect.

In Massachusetts, physicians as well as midwives, etc., are required to report (Revised Laws, ch. 75, secs. 49, 50).

The legislation up to 1911 is summed up by Kerr, "Ophthalmia Neonatorum: An Analysis of the Laws and Regulations Relating Thereto in Force in the United States," Pub. Health Bull. no. 49, U. S. Pub. Health Service, Oct., 1911.

disease which threatens vision. Although rigidly, excluded by the immigration service, cases are not infrequently found in the United States. It should be reported and measures prescribed by the health authorities to prevent its extension. It is favored by crowding and personal uncleanliness. Since it is spread by rubbing the eyes with infected towels, handkerchiefs, fingers, etc., prophylactic measures consist in the avoidance of transferring infection in such ways. The patient should have his own towels, handkerchiefs, washbasin and the like, and should observe personal cleanliness, avoiding such contact as might transmit the disease. It should be excluded from schools.

V. MISCELLANEOUS DISEASES

INFANTILE PARALYSIS

Infantile paralysis (*Acute anterior poliomyelitis*) is an acute infection of the nervous system affecting particularly the spinal cord. The causative microörganism is as yet unknown. The disease is not as yet well understood, but great attention has been directed to it in recent years on account of the outbreaks which have occurred. The partial paralysis from which the disease is named persists permanently in many cases.

Transmission. — Of the following possible modes of transmission (1) and (2) have thus far been demonstrated:

1. *Contact.* — It is supposed that the virus is discharged by way of the nose and mouth of the patient and enters the system of the victim in the same way. Thus the disease would be spread in the same way as diphtheria and scarlet fever. There is experimental evidence to support this theory, though just how much danger there is in contact infection is not at all known. On the other hand, it is argued by epidemiology, against the importance of this mode of transmission: that in actuality the disease does not show any noticeable tendency to spread by contact,

and that it does not show a maximum incidence at the same time as diphtheria, scarlet fever, etc., which are spread by nose and throat secretions.

2. *Insect Transmission.* — In some ways infantile paralysis appears epidemiologically to be an insect-borne disease, and experiments have shown that the virus may be transmitted (from monkey to monkey) by the bite of the stable fly (*Stomoxys calcitrans*).

3. *Other Modes.* — Experiment suggests that the disease may be conveyed by dust. Food infection, inoculation through wounds and other modes are possibilities.

Human carriers of the disease have been detected, and are suspected to play an important part in its propagation.

INCIDENCE. — Apart from greater recognition, infantile paralysis has apparently been on the increase in recent years. In the Registration Area in 1911 there occurred 1060 deaths, which argues the existence of an indefinitely greater number of cases. The disease not only attacks infants, but older children and (though less frequently) adults may contract it. The incidence fluctuates from year to year and from place to place.

Control. — Until more is known about the modes of transmission, cases should be reported and isolated in the usual manner, with disinfection of all discharges from the body. Insects should be excluded by screens. For prophylaxis on the part of the nurse, physician and other persons possibly exposed to infection, gargles, sprays, and nose washes of 1 per cent peroxide of hydrogen are recommended. (Rosenau.) The proper duration of isolation is entirely unknown, but it seems wise to keep children at home from school for three weeks after recovery from acute symptoms; a longer time would probably be safer.

As an auxiliary measure the suppression of flies (which include the stable fly) should be adopted (see Chapter VI). House and street dust should be kept down. "During epidemics children should be kept away from public

gatherings, prohibited from using public drinking cups and special attention given to the diet to prevent gastrointestinal disorders, for many a case of infantile paralysis starts with a digestive upset." (Rosenau.)

There is great need of further knowledge from epidemiological study of cases and carriers as well as from laboratory experimentation.

CHICKENPOX

Chickenpox is a mild disease of the class of communicable exanthemata (or eruptive diseases). It should be made reportable for the reason that it may be confused with smallpox. In the presence of smallpox suspicious cases of chickenpox should be examined in order to make sure they are not smallpox. The differential diagnosis of the two diseases is mentioned under the head of Smallpox.

Children having chickenpox should be reported by the health department to the school authorities in order that they may be excluded. Chickenpox is subject to home isolation and disinfection at the will of family and physician. No restrictive measures are taken by health authorities. The mortality is slight, complications and sequelæ rare.

SEPTIC SORE THROAT

A milk-borne disease of peculiar interest is "septic sore throat," a severe type of tonsillitis which has occurred in a number of epidemics. The infection is presumed to be a streptococcus infection from human cases, though streptococci found in udder inflammations of cows have also been suspected. The most conspicuous epidemic in this country occurred in Boston and vicinity in 1911 (1400 cases). It has been instructively studied by Winslow,[1] who concludes: "The lesson to be drawn from the outbreak is that even a most carefully supervised milk supply is open to the

[1] *Jour. Inf. Dis.*, 1912, vol. X, no. 1, pp. 73–112.

danger of grave infection from carrier or unrecognized cases of disease. The only real safeguard against such catastrophes lies in *pasteurization*, carried out by the holding system and preferably in the final package."

Cases of septic sore throat should be *reportable* with the name of the milk dealer. Cases should be excluded from schools. On epidemics see page 288.

TETANUS

While tetanus is today not ordinarily transmitted directly from person to person, it is a dangerous infectious disease, the germs of which are widely spread in the environment, and hence requires notice here. Tetanus is an acute and (in the absence of antitoxin treatment) fatal intoxication of the nervous system, characterized by muscular spasms (hence the popular name "lock-jaw"), and caused by the toxin of the tetanus bacillus.

Tetanus is almost always a wound infection. It may, however, gain admittance through contaminated bacterial vaccines, antitoxin sera, vaccine virus and other products used in human therapy, though since the institution of more careful supervision of biological products this rarely occurs. Tetanus has in a few cases occurred as a complication of vaccination, due either to impure virus or wound infection. Gelatin may contain tetanus spores, and when used for subcutaneous injection as a hæmostatic should be thoroughly sterilized. "Idiopathic tetanus" is the term used when the site of the germ in the system is undetected.

The bacillus is harbored and thought to grow in the intestinal tracts of herbivorous animals, notably the horse; it passes off in the manure, forms highly resistant spores [1] and through conveyance by manure, dust, flies, etc., becomes very widely disseminated. It is one of the very few infectious diseases, the germs of which exist in considerable

[1] See p. 571.

numbers for long periods of time in the soil, dirt, dust, etc., in the environment.

1336 deaths from tetanus occurred in the Registration Area in 1911. Nearly all of these might have been prevented had wounds been properly treated or tetanus antitoxin administered in time.

Control. — The prophylaxis of tetanus rests with the physician. The first precaution is the *proper surgical treatment of wounds.* Punctured, lacerated and contused wounds are more susceptible than clean-cut or superficial wounds, for the reason that the bacillus — being a strict anaërobe — develops only in the absence of air and oxygen. Even small wounds, by splinters, etc., may develop tetanus if conditions are favorable to it. Rough wounds, such as those caused by rusty nails and by gunpowder explosion, are particularly dangerous. The objects of the surgical treatment are to cleanse, or even disinfect the wound, and to avoid anaërobic conditions.

The second precaution is the *prophylactic use of tetanus antitoxin.* This means the prompt administration of a small dose — at least 1500 units — in the case of all suspicious wounds. The promptness of administration is important for the reason that once symptoms appear the damage is largely done.[1] It may be necessary to repeat the dose every ten days or two weeks in order to keep up the immunity in case the wound does not heal well.

The *duties of the local health authorities* embrace educating the public as to the importance of obtaining proper surgical treatment of wounds, and supplying and encouraging the use of antitoxin (free in the cases of indigent persons).

[1] However, the administration of heroic doses late is sometimes successful. "As soon as symptoms appear 20,000 units or more of tetanus antitoxin should be introduced directly into the circulation by intravenous injection; some antitoxin may also be injected into the nerves leading from the wound. In tetanus, as in diphtheria, time is the important element. A few units introduced early are worth more than thousands late." (Rosenau.)

Dangerous Fourth-of-July celebrations should be discouraged.[1]

GLANDERS

"Glanders, or farcy, is a widespread communicable disease of horses, mules, asses and other animals, and is readily communicated to man. In both man and horses it is remarkable for its fatality. This disease is characterized by the formation of inflammatory nodules either in the mucous membrane of the nose (glanders) or in the skin (farcy)." (Rosenau.)

The cause of glanders is the *Bacillus mallei*, which is usually communicated from animal to animal or to man (occasionally from man to man) through contact infection. The germs are shed off in the discharges from mouth and nose, and enter the system through the skin or mucous membrane.

The diagnosis of glanders may be made according to any one of five methods, the most satisfactory of which is the complement fixation (serum) test.[2] Mallein in skilled hands is useful, but not accurate in all cases.

The germ is destroyed by the usual disinfection methods, but thorough cleanliness is necessary in order to do away with the filth in which it may be embedded.

Control. — The radical measure is the elimination of glanders in horses. Frequently the health authorities are charged with this responsibility. All cases of glanders in beast or man should be promptly *reported* by veterinary, physician or owner of animal. If necessary, provision

[1] Under the leadership of the American Medical Association a highly successful campaign has been carried on in recent years against the dangerous accidents incident to Fourth-of-July celebrations. Not only has there been brought about greater precautionary treatment of wounds and prophylactic use of antitoxin, but the occurrence of accidents has been diminished through saner methods of celebration. This is true preventive work of an important kind.

[2] Described in Bull. 136, Bureau of Animal Industry, Dept. of Agriculture, Washington, D. C.

should be made for serum diagnosis. Any animal affected with the disease should be at once destroyed and the carcass properly disposed of, and the stable should be vacated and disinfected (see Appendix A). Suspected animals, other animals in the stable and animals which have been otherwise exposed should be segregated in a separate stable and subjected to the blood serum fixation test; those reacting should be destroyed, carcasses properly disposed of and stable disinfected. Surveillance of the remaining animals, with blood serum tests every three weeks, should be continued until the infection has been eliminated. Needless to say, each animal under surveillance should be isolated, with separate troughs, harness, brushes and other utensils.

In disinfection pay special attention to troughs, water buckets, bits, halters and other articles readily infected by secretions of nose and mouth. Those handling infected animals, carcasses or articles should wear gloves which may be destroyed or disinfected and should avoid possible infection by nose and mouth.

Vigorous measures are necessary for the control of glanders, which frequently means great pains and expense and the destruction of valuable animals, but the authorities should not hesitate to proceed firmly and thoroughly.

Glanders among horses frequently occurs in epidemics, during which it is spread by watering troughs, hitching posts and other media of contact. It is therefore sometimes necessary to close all such troughs and to place warnings on public hitching places. The existence of many mild and missed — perhaps even carrier — cases among horses makes the disease difficult to control except by strict measures.

The prevention of infection from a human case of glanders would consist in disinfection of sputum and discharges from the nose, and measures to avoid infection of other persons by contact.

ANTHRAX

Anthrax is another of the diseases which may be transmitted from animals to man. It is primarily a disease of horses, cattle, sheep and other cloven-hoofed animals, caused by the *Bacillus anthracis*. It is known also as splenic fever, wool-sorter's disease (anthrax of the lungs), and malignant pustule (anthrax of the skin). The following modes of infection may be mentioned: by the skin, i.e., through abrasions, etc.; by the lungs, apparently through inhalation of spores; by the digestive tract, through eating raw or incompletely cooked infected meat; ordinary flies may convey the germ to the skin, and the disease may be inoculated through the bite of the stable fly. Anthrax spores have been found in pastures where infected animals have been confined. Persons working about the carcasses of slaughtered animals, butchers and persons who handle hides and hair of infected animals may be infected. Veterinary surgeons may contract the disease through accidental infection in autopsies. It is a rapidly fatal but fortunately not a common disease.

Control. — The control of anthrax is a question of the disease in animals. In infected animals the germs exist in great numbers in the internal organs, expecially the spleen, and in the blood, which turns dark. On being exposed to the air the bacilli form highly resistant spores;[1] hence great care should be taken to avoid opening any infected carcass or letting the blood. Infected carcasses should either be burned or be buried to a depth of at least three feet so as to avoid soil infection. In large slaughter-houses they may be "tanked," i.e., subjected to prolonged exposure to steam under pressure.

Hides, horse-hair and other raw material used in trades

[1] See p. 571.

and liable to contain the infection of the resistant anthrax spore should be disinfected before use.[1]

PELLAGRA

Pellagra is a disease of obscure causation which has become prominent of recent years. In 1911, 659 deaths were ascribed to it in the Registration Area, and Lavender, of the U. S. Public Health Service, estimates that there are now between 25,000 and 50,000 pellagrins in the United States.

There are two principal theories as to the *causation:* (1) that it is due to the ingestion of spoiled corn or maize; (2) that it is a communicable disease transmitted by the bite of an insect.[2] It is on the first of these theories that preventive measures looking to corn supplies have been adopted in Italy, which is one of the centers of the disease. Observers working on the insect theory have brought forward evidence tending to convict the Simulium fly, the Stomoxys fly (or ordinary stable fly), the house fly or some species of mosquito, which, however, is not conclusive. It has also been observed that pellagra is more prevalent where poverty, uncleanliness, overcrowding and other poor social conditions are present. As the result of recent investigation, the Thompson-McFadden Pellagra Commission of

[1] The following method is recommended by Pouder (*Lancet*, London, vol. CLXXXI, no. 4601, pp. 1247–1314), as quoted by Rosenau:

" The dry hides are placed for 24 hours in a " soak " which is made to contain 1 to 2 per cent of formic acid and 0.02 per cent of bichlorid of mercury, and then salting them with sodium chlorid. The action of the " soak " is to swell up the fibers of the hide by causing them to absorb water, the result being that the hide returns to a condition closely resembling that in which it was taken from the animal's carcass. This permits the bichlorid of mercury to permeate and exert its germicidal action."

[2] Experts of the U. S. Public Health Service have recently been working on the theory that pellagra is one of the so-called starvation diseases, like scurvy and beri-beri. Intestinal organisms have also been claimed to have been found.

the New York Post-Graduate Medical School and Hospital has recorded itself as discarding the spoiled maize theory; the evidence favoring the theory that the disease is conveyed by a blood-sucking insect, very possibly the stable fly.

Solution of the problem raised by pellagra must be sought in the outcome of such researches, as recorded in current medical and public health literature and in the proceedings of the National Association for Study of Pellagra.[1]

LEPROSY

(*Lepra*)

Leprosy is occasionally met with in the United States, though conditions are unfavorable to its spread in this country. It is caused by the *Bacillus lepræ* and is communicable, though to a less extent than popularly supposed. The mode of infection is probably always by direct contact, but "prolonged and intimate association with a leper ordinarily seems necessary to contract the infection." (Rosenau.)

Leprosy should be reported. Prophylaxis consists in cleanliness, care of infected discharges and the usual measures to prevent ordinary contact infection. Particular attention should be paid to the nasal secretions, which at one stage or another become infective in the great majority of cases. Some degree of isolation may be necessary for some cases, though (according to Rosenau) there should be, in this country, little objection to giving liberty to a careful leper of cleanly habits. Segregation of lepers in institutions is the commonly accepted administrative measure. The disease is not invariably fatal, but may be treated like tuberculosis, which in certain respects it resembles.

[1] Cf. Rosenau, "Preventive Medicine and Hygiene," 1913, and Roberts, "Pellagra: History, Distribution, Diagnosis, Prognosis, Etiology, Treatment," 1912.

Dr. H. W. Hill[1] has pointed out the non-identity of modern leprosy and Biblical leprosy, with the statement:

> Modern leprosy should never be called by that name, but always designated as *lepra;* and every effort should be made to point out that it is produced by a well-known germ, belonging to the tuberculosis group; and is in clinical effect a second cousin, so to speak, of tuberculosis, but much more infectious — a disease to be supervised and prevented from spreading, of course, but calling for no panic-stricken flights from its neighborhood and no especial hardships or cruelty to its unfortunate victims.

MENTAL DISEASES

We may here mention the various insanities and psychoses which are chiefly due to syphilis, alcoholism and heredity. While this class of disease is not at present subject to direct attack by health authorities, it may nevertheless be said that preventive methods may reduce one set of the underlying causes — syphilis, typhoid fever and other infectious diseases; while sanitation tends to improve some of the conditions which favor another — alcoholism.

OTHER DISEASES

Some other diseases which are spread by milk or meat are mentioned under the head of Food Supplies. Tropical diseases and other diseases of interest chiefly to the parasitologist or quarantine officer are omitted. In case of the appearance of a rare communicable disease, local authorities should notify the state and Federal authorities and be guided by their advice.

Industrial poisonings are mentioned under the head of Factory Hygiene.

The control of the *drug habit* through registration of cases and restrictions on the sale of habit-forming drugs has recently been taken up by some local health author-

[1] *Am. Jour. Pub. Health*, 1914, vol. IV, no. 7, p. 605.

ities, and was extensively discussed at the 1914 meeting of the American Public Health Association.[1]

Progressive health authorities may also interest themselves in the movement for suppression of *patent medicines* and *quack frauds* which has been ably begun by the American Medical Association and the press.

THE SCHOOLS IN RELATION TO COMMUNICABLE DISEASE

School Exclusions. — Cases of diphtheria, scarlet fever, measles, whooping cough, chickenpox, mumps, etc., should be promptly reported by the health office to the school authorities (see page 105) in order that the latter may see that the rules as to exclusions of children in infected families and houses are strictly obeyed. The rules should be made by the health authorities (unless there is a system of medical inspection in the schools, in which case the medical inspector should be consulted) and should be enforced by health and educational authorities in coöperation.

The rules for exclusion adopted vary with different authorities, but under each of the principal diseases, in previous pages, we have given some indication of the best practice. For others the practice may be inferred from the nature of the disease. There are a number of minor contagious affections of children which the health department leaves entirely to medical inspectors of schools.

The same rules should apply to all public, parochial and private schools, Sunday schools and other occasions of commingling of children. Such rules apply with special force to the primary schools, where children mingle inti-

[1] Terry, " Drug Addictions, A Public Health Problem," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 1, p. 28. Cf. Wilbert and Motter, " Digest of Laws and Regulations in Force in the United States relating to the Possession, Use, Sale, and Manufacture of Poisons and Habit-forming Drugs," Pub. Health Bull. no. 56, U. S. Pub. Health Service, 1912.

mately; in the high school there is comparatively little association and the rules need not there apply except under unusual conditions.

As to the exclusion of teachers living in infected families, each case should be judged on its merits. There is less contact between teacher and pupil than between pupils, and the restrictions on teachers (except, perhaps, in the kindergarten grades, where chances of contact are more frequent) need not, therefore, be so strict. If the conditions are satisfactory, they may be permitted to continue at their work. Otherwise, the case may be sent to the hospital, or the teacher may live elsewhere during the course of the disease.

Closure of Schools. — The question of closing the schools in order to check epidemic disease presents itself at times to the health authorities, particularly in connection with measles. Similar question arises in regard to Sunday schools, moving picture theatres, children's parties and the like. It is a question not to be lightly decided, for the closure of schools means a loss to the community warrantable only by grave reasons.

The problem is really one as to the rôle of the schools in the propagation of communicable disease. The popular idea that the schools are great distributors of disease is not clearly confirmed by careful observation and study. The chief argument for it is the increase of scarlet fever, diphtheria, measles, etc., during the school year, but this fact is by no means conclusive, for these diseases all affect the respiratory system and we know that all respiratory diseases are much more prevalent in the winter season. Thus there may be merely a coincidence between the school term and the winter season. There is, of course, no question but that infection does take place through association of children in the schools, but the amount of it, as compared with infection through association outside, has probably been exaggerated.

The fact that there are considerable numbers of cases in the schools does not necessarily signify that they originated there. If there is a school focus of infection it will appear in one class-room, one grade or one school, and may be dealt with separately by rigid medical inspection (in diphtheria, culturing) and exclusion of contacts. Nor does the dying-out of an epidemic after school closure necessarily mean that the latter was the cause of the cessation, for epidemics frequently die out of themselves for lack of further susceptible human material in their path. Measles, for example, recurs in seemingly inevitable waves every few years, sweeping through the community in spite of the most rigid measures.

It is in any case bad practice to close schools and keep them closed for weeks without any apparent benefit. If there is any benefit in school closure it will be noticed immediately after the lapse of the incubation period of the disease (say two weeks for measles). But experience frequently shows that there are other factors than the school at work, and that it is useless to keep the latter closed for long periods.

Let us consider the apparent effects of closing school, and in doing so observe the important distinction between urban and rural conditions.

1. In *urban districts* there may be just as many opportunities for contact in play in the streets and houses as in school — perhaps more. Furthermore, the school is the only place where *medical inspection* can be performed, and if the school is closed this important means of detecting carriers and mild cases is cut off.

Children associate most closely in their play; hence, apparently, it is the association in play occasioned by the school, rather than the comparatively small amount of contact in the classroom, which favors spread of infection. If this opportunity for play association be compared with the opportunities for such association in homes, streets and

elsewhere (for which there is more time when schools are closed), it will be seen to constitute but a part of a wider problem which is solved only in part — often, perhaps, in comparatively small part — by school closure. (It is assumed that the opportunities for contact infection in the school plant — through common drinking cups, roller towels, etc. — have been so far as possible removed.)

Many of the best authorities now believe that the reduction of opportunities of contact infection in the school and careful medical inspection of school-children to detect incipient cases — rather than school closure — are the most effective ways of controlling communicable disease even when epidemic. In spite of popular clamor, observant city health officers are becoming less and less inclined, on the whole, to order closure of schools.

A recent paper[1] sums up the above view in an admirable manner. From it the following quotations are taken. (In quoting some of the phrases have been combined for the sake of concentration.)

The arguments in favor of closing the schools seem to be based chiefly upon tradition and public demand and not upon careful study of the manner in which infection is transmitted in and out of schools. . . .

There is undoubtedly a rise in the curve of incidence of the commoner communicable diseases of childhood shortly after the opening of the schools in the autumn, and the natural inference is that the opening of the schools is the cause of this rise, but a more careful study of the curve shows that this is not the fact.

[As further data tending to diminish the importance attributed to the schools, figures are given showing that there are more cases of scarlet fever during the years *before* children enter school than after.]

In two instances lately [in Newton, Mass.] where the outbreaks were due to missed cases which were in the schools for some time before

[1] Curtis, "Shall We Close the Schools During Epidemics?" *Am. Jour. Pub. Health*, 1914, vol. IV, no. 2, p. 135; see also Chapin, *Rpt. of Supt. of Health*, Providence, R. I., for 1912, pp. 34–41; Roach, "The Role of the School in the Spread of Scarlet Fever," *Am. Jour. Pub. Health*, 1912, vol. II, no. 6, p. 450; Note regarding English study, *Am. Jour. Pub. Health*, 1912, vol. II, no. 4, p. 313; Editorial, *Am. Jour. Pub. Health*, 1912, vol. II, no. 3, p. 168.

discovery, the first cases found were not children who sat near the infecting cases nor were they in the same grade, but were those who were their playmates and companions out of school. More recently, in an outbreak of diphtheria, the cases were similarly infected. . . . So far as they go these instances seem to show that infection is not contracted in the school-room as frequently as is usually supposed.

If the schools are closed when an outbreak occurs, the children are turned loose from supervision; they mingle freely with one another in the streets, on playgrounds and in one another's houses. They are enjoying themselves thoroughly and are unwilling to admit that they feel ill, lest they be kept at home and prevented from having a good time. For this reason they will not say they feel ill until they are possibly well advanced and they may be active sources of infection for some time before it is discovered that they are ill. . . .

If the schools are kept open and the children continue in the classrooms as usual, they are under strict observation and examined daily by the school physicians, suspicious and infected cases being sent home for observation or treatment. . . . It seems, therefore, that keeping the schools open offers the best chance of safety for the scholars both collectively and individually. . . .

The school physician and nurse should be detailed to the school where the outbreak has appeared and instructed to examine every child daily,[1] excluding such as appear ill or suspicious. This can be done with very little disturbance of the school work. A note must be sent to the parent stating that the child seems, or is, ill and must be seen by the family physician. Suspicious cases must be ordered to remain at home until further notice, and, if necessary, must be visited later in order to settle the diagnosis. Absentees must be rounded up and examined in order to find out why they have been kept at home. If they are ill, they must be isolated, and, if well, urged to return to school. . . . In small cities the school physician can be detailed to the affected school during the outbreak, leaving the other schools in his district to be covered by one of his colleagues.

Even if extra help should be required the extra expense incurred will be more than offset by the shortening of the duration of the outbreak and the lack of disturbance to the schools.

When the schools are closed certain expenses such as salaries, etc., continue without any return and there is also an added economic loss from the lessening of the time for instruction, so that the children in the affected school or schools are behind others in the same grade in the unaffected schools.

[1] Such examinations should be made *before* the children enter school each day. — J. S. M.

[The author then discusses the necessity of persuading school committees (when vested with this power) to keep the schools open and of inducing parents to keep their children in attendance.]

2. In *rural districts*, on the other hand, adequate medical inspection is not so readily obtained, while closing the schools does operate to scatter the children and hence lessen the opportunities of infection. The case here is summed up in an editorial in the *American Journal of Public Health.*[1] After remarking that in country districts the health officer is commonly a part-time physician whose medical practice would make the greatest demands at just those times of epidemic when he would be most needed as medical inspector, the writer concludes:

> In the country the children come to school from widely separated homes. They live in little scattered groups whose members should be quite free from risk from the outside. The school brings them together. At their homes they do not gather in great groups on the streets. The situation is radically different from that in the city, and it would seem that the greater contact is in the school.
>
> The rural school would be of less consequence as a focus were a system of adequate inspection possible. But here again is a weak spot in rural health administration; good school inspection is costly and in the country it is difficult to maintain of standard quality.
>
> Under these circumstances and until the efficiency of rural health work can be maintained at a high standard, may it not be well to recognize a differing environment and allow that schools and churches, even, . . . may be closed in times of serious outbreaks as a measure for the protection of the people?

3. The matter may be summed up in saying that in sparsely populated country districts, where the children do not associate to any general extent except at school, closure may be effective; but that in towns and cities where there is certain to be a great deal of association in any case, it is of doubtful if of any value. In the latter case, taking into account the educational and economic losses involved, it would appear, on the above argument, inad-

[1] 1914, vol. IV, no. 5, p. 436.

visable to close schools, reliance being placed instead on careful medical inspection.

MEDICAL INSPECTION OF SCHOOL-CHILDREN

Medical inspection systems now exist in many public schools and should be universal. Such inspection has two objects: (1) the general physical welfare of each child, and (2) the detection and exclusion of communicable disease. The former object consumes the greater effort and expense, but only the latter will concern us for the present.

Detection and Exclusion of Communicable Disease. — Medical inspection of schools plays an important part in that surveillance over childhood which is one of the foundations of the control of communicable disease. The factors in such surveillance are: the parents, the family physician, the health authorities, the teacher, the school medical inspector and the school nurse. How important is the part played by each of these? The parents frequently fail to recognize incipient cases of communicable disease in their children. The family physician has no opportunity to detect such disease unless called by the family; frequently he is called late or not at all. The health authorities in their turn depend upon official notification from physicians. In the school, the teacher may, or, more frequently, may not, be able and apt to recognize suspicious symptoms in children; her chief concern is for instruction, not physical inspection. But the medical inspector is a specialist, one of whose principal objects is to detect incipient or atypical communicable disease; and if he is assisted, as he should be, by the school nurse, his effectiveness is greatly enhanced. Medical inspection is therefore a main barrier against communicable disease.

The ideal plan is to have the physician visit the school in the morning as soon as possible after opening. Suspicious cases have meanwhile been singled out from the

classes by the school nurse by means of a general inspection, and kept in a special room for examination by the physician. Such inspections should be performed early, so that any excludable cases may be detected before the pupils mingle together in classes and play. Teachers should receive simple instructions on the early symptoms in children. The school nurse "follows up" pupils for whom examination by family physician or home treatment has been indicated, in order to see that the parents give proper attention. Complete medical inspection of each pupil is made once a year. Such an ideal plan may not be possible in all communities, but should be adopted as far as possible. For further details see the references below.

Medical inspectors should be required personally to report all cases promptly to the health department, using a special form for that purpose.

(For further details and discussion of medical inspection of schools, with references, see Chapter II.)

SCHOOL HYGIENE AND SANITATION

School Sanitation. — The most popular measure for restricting communicable disease in schools is room fumigation. This process is supposed to wipe out all infection and gives a sense of security to parents and teachers, which, however, we now know is false. It is safe to say most of the room fumigation as ordinarily performed in school-buildings today is ineffective if not needless. The present day science of epidemiology shows that the source of infection in schools is not the atmosphere of an "infected school-room" but the mild and unrecognized cases of communicable disease which spread the disease by contact infection among the children. It is a common experience to go to great pains and expense to disinfect school-rooms only to have fresh cases appear as if no "precautions" had been taken.

The best safeguards are cleanliness and a simple use of disinfectants. Things frequently handled or touched — e.g., door-knobs, railings, gymnastic apparatus, toilet fixtures and the like — should be cleansed thoroughly once a week and should be gone over each day with a cloth wet with formalin solution, coal-tar mixture, or other reliable disinfectant. Water-closets should be kept scrupulously clean and the seats, door-knobs, chain-pulls, etc., should be disinfected daily in the manner just described. If, in spite of the cleansing, a deodorant is needed in toilet rooms they may be whitewashed or one of the deodorants mentioned on page 591 may be used.

Dust should be wiped off furniture with damp cloths (not feather dusters, which merely move dust without removing it). As to the floors, floor-oil is an effective dust-eliminant. Black-board chalk should be removed after school hours with wet cloths, not erasers.

Common drinking cups and common towels should be absolutely tabooed; sanitary fountains and paper towels may be substituted. Instead of the common soap cake, liquid soap apparatus may be used.

Why fumigate desks (which are used by the children individually, not in common) and other furniture (which is scarcely touched by the children at all) when the amount of infection spread by these is apparently so small as to be negligible, and at the same time neglect — as is frequently the case — the real means of common contact?

Instruction in Hygiene. — School instruction should not only include a course in general hygiene but should dwell especially on the means of avoiding contact infection. This should begin with the youngest children — even in kindergarten, where the teachers may inculcate habits of personal cleanliness and avoidance of spreading one's secretions or taking up those of others. As soon as children can read sufficiently well they may be given cards contain-

ing simple precepts of the kind illustrated in the following example:[1]

REMEMBER THESE THINGS

Do not spit if you can help it. Never spit on a slate, floor or sidewalk.

Do not put the fingers into the mouth.

Do not pick the nose or wipe the nose on the hand or sleeve.

Do not wet the fingers in the mouth when turning the leaves of books.

Do not put pencils into the mouth or wet them with the lips.

Do not put money into the mouth.

Do not put pins into the mouth.

Do not put anything into the mouth except food and drink.

Do not swap apple cores, candy, chewing gum, half-eaten food, whistles or bean blowers, or anything that is put into the mouth.

Never cough or sneeze in a person's face. Turn your face to one side.

Keep your face and hands clean; wash the hands with soap and water before each meal.

LIBRARIES

Epidemiology teaches that the dangers of transmission of disease by books are comparatively small. Nevertheless some precautions are advisable. First, cases of communicable disease (and terminations of cases) should be reported by the health authorities to the circulating libraries, public and private. Then books returned from quarantined families should be subjected to disinfection (see Appendix A). If they are of little value, and especially if they have been handled by the patient, they should be burned, preferably without being taken away from the house.

[1] Composed by C. V. Chapin, and used in the public schools of Providence, R. I. Placards bearing the same text are posted in conspicuous places in the school-rooms. In the public schools of New York City jingles on such texts have been printed on cards and circulated. Such verses doubtless fix themselves more firmly in the minds of young children than abstract prose texts.

With tuberculosis there is some slight possibility of transmission by books. Tuberculosis patients need not, however, be forbidden to use library books if such books are effectively disinfected by the health or library authorities. Clean and careful consumptives can probably use books without special danger to other persons even without disinfection.

GENERAL REGULATIONS AGAINST CONTACT INFECTION

Under the head of contact infection were suggested some of the general modes of infection among the public, involving hand-to-hand and hand-to-mouth transmission. We may here mention some of those which should be dealt with by sanitary regulation.

Common Drinking Cups, Roller Towels, etc.[1] — The *common drinking cup* has long since been convicted as a medium of infection, and should be abolished in all public places, as has been done by various state and local laws. In its stead may be substituted the automatic drinking fountain or individual cups. Paraffined paper cups which may be discarded after use are to be recommended when not too expensive. Bubbling fountains should be so designed that it is impossible to apply the mouth before the water begins to flow. Ordinances should enumerate specifically the places — schools, hotels, railroad stations, parks, theaters, libraries, churches, municipal buildings, public institutions, factories and the like — where the regulation is to apply. This is most properly a subject for state legislation, for the state authorities alone can properly enforce it in railroad trains and steamboats. Local authorities should, however, enforce the state law, or, if necessary, pass their own ordinances. Common drinking cups and common towels have been abolished by Federal authority in interstate railroad trains, and vessels and stations.

At soda fountains, thorough washing of glasses should be insisted upon or paper cups substituted. The washing of glasses in saloons is also a matter for inspection.

The objections to the common drinking cup apply with equal force to the *common or roller towel*, which in addition plays a rôle in the spread of diseases of the eye. Towels used in schools, public lavatories, hotels, restaurants, department stores, etc., and the common bar towel, fall

[1] Cf. Kerr and Moll, "Common Drinking Cups and Roller Towels: An Analysis of the Laws and Regulations Relating Thereto in Force in the United States," Public Health Bulletin no. 57, U. S. Public Health Service 1912.

under this ban. Individual towels which are used only once before being washed, or the paper towels which are now supplied at a low cost by manufacturers, should be substituted. In this connection it would be well to abolish common soap cakes and toilet articles, particularly in schools, where the possibilities of contact infection are most to be guarded against. Liquid soap apparatus for lavatories may readily be substituted.

Among other possible mediums of contact infection to which attention may be drawn — though of secondary importance — are finger-bowls, the forks used in free lunches, cigar-cutters (the cigar being moistened with saliva before cutting), lung testers, and suction shuttels in textile factories. Milk tickets which are used more than once should be forbidden. The possibility of contamination of ice-water tanks through unclean methods of handling the ice should not be overlooked, nor the contamination of bread and other foods through improper handling. Various other modes of public or semi-public contact infection will suggest themselves.

Barber Shops. — Skin diseases and other affections may be acquired in barber shops. No person affected with venereal disease should be permitted to act as a barber. The following rules (Ordinance of Montclair, N. J., Board of Health) indicate the kind of regulation that may be applied to barber shops.

> SEC. 1. Every barber shop within the Town of ——— shall be open to this Board for inspection at any time, and the following rules shall be observed therein:
>
> (*a*) All barber shops, together with all furniture, shall be kept in a clean and sanitary condition.
>
> (*b*) Mugs, shaving brushes, razors, scissors, clipping machines, pincers, needles and other instruments shall be sterilized, either by immersion in boiling water or in alcohol of at least sixty per cent strength, after each separate use. Combs and brushes shall be thoroughly cleaned with soap and water after each separate use.
>
> (*c*) Clean towels shall be used for each person.
>
> (*d*) Alum, or other material used to stop the flow of blood, shall be applied only on a clean towel or other clean cloth.
>
> The use of powder puffs and sponges is prohibited, except that a sponge owned by a customer may be used on him.
>
> (*e*) Every barber shall thoroughly cleanse his hands immediately before serving each customer.
>
> (*f*) Every barber shop shall be well ventilated and provided with running hot and cold water.
>
> (*g*) No barber shop shall be used as a sleeping room.

(*h*) A copy of this article shall be kept posted in plain view in every barber shop.

SEC. 2. Any person violating any of the provisions of this article shall, upon conviction thereof, forfeit and pay a penalty of ten dollars for each offense.

[Provision recently added:]

No person shall hereafter operate a barber shop until he has filed with the Board of Health a certificate signed by a regularly licensed physician, who is approved by the Board, that all persons who wait upon customers in his establishment have been examined by the said physician within 30 days and show no evidence of any communicable disease. Such examination shall include any tests that the Board may, by resolution, prescribe. Like certificates must thereafter be filed every three months on the first days of January, April, July and October of each year for examinations that have been made of all such persons during the previous month, and additional certificates must be filed for all new employees as soon as they begin their duties. All certificates must be on forms furnished by the Board and must give the name of every person examined. [Penalty, $25.]

Public baths and swimming pools have been suspected of transmitting eye affections, typhoid fever and other diseases. They may be disinfected and at the same time rendered sweeter, with a very considerable saving of water which would otherwise have to be changed, by a dose daily to weekly of 1 to $1\frac{1}{2}$ pounds of bleaching powder (hypochlorite of lime) per 100,000 gallons.[1]

Some health departments attempt to regulate "rummage sales" of old clothes, the stocks of rag-dealers and the like, requiring a so-called disinfection of the articles. Efficient disinfection is impossible without great trouble and expense, and the modern disproof of the importance of fomites infection indicates that the supervision of such matters is, in any large view, a waste of time and labor. Better to put more attention on the real and obvious modes of contact infection.

EPIDEMIOLOGY

(The following section is introduced not only for its particular suggestions in dealing with epidemics, but also for the general indications which it gives regarding the various modes of disease transmission.)

The practical study of the characteristics of epidemics, or, more generally speaking, of the modes of transmission of communicable diseases, is known as epidemiology. This science, in spite of its somewhat imposing name, consists simply in the application of common

[1] Hooker, "Chloride of Lime in Sanitation," 1913, p. 29.

sense, joined with a basic knowledge of the modes of transmission, to the problems arising in practical public health work. It is a species of scientific detective work. We can here give merely a sketch of the methods to be followed.

TERMS. — Any outbreak of communicable disease may be termed an *epidemic*. The following allied terms are also applied to communicable disease:

Endemic. — Constantly present in a community to a greater or less extent.

Pandemic. — Epidemic over wide areas.

Prosodemic. — Spreading continually from person to person in a chainlike fashion (Sedgwick and Winslow).

Epizoötic. — Attacking many animals at once; — said of diseases analogous to epidemic diseases among men.

These terms may be used substantively as well as adjectively. Thus we speak of an " epidemic " or of an " epidemic disease."

The Prevention of Epidemics. — The importance of scientific safeguards against the occurrence of epidemics cannot be overestimated; anyone who has surveyed the history of the numerous epidemics which have occurred even within recent years is struck with their disastrous effects. The cases in individual milk-borne epidemics not infrequently run up into the hundreds (or even, as in the instance of typhoid fever in Boston, 1908, into four figures); hundreds or thousands of preventable cases occur every year in communities having polluted water-supplies, while the constant succession of contact cases occurring everywhere often outweighs even the other two classes.

Care and watchfulness on the part of the health authorities will prevent many an epidemic, or at least check it in the beginning. Health officers should be familiar with the " normal,"[1] or usual, rates of occurrence and distributions of the various communicable diseases. Observation shows that in any given community the cases of, say, scarlet fever or diphtheria occur each year with considerable regularity as to numbers in the various sections of the town and are pretty evenly distributed among the schools and on the routes of the various milk dealers (taking into account the number of customers served by each). There are also important " normal " seasonal distributions. Thus scarlet fever, diphtheria and other diseases in which the infection is spread through the secretions of the nose, throat and respiratory system, and which are contracted through those channels usually show a regular increase beginning in September or October, rising to a maximum in mid-winter, falling off during the spring, and remaining at a minimum during the summer months. Measles, however, is somewhat an excep-

[1] For comment on this term, see p. 501.

tion in that the winter maximum does not usually occur until late winter or early spring. Typhoid fever, in communities where water-borne typhoid is eliminated and only the "residual"[1] remains, has a low incidence during the winter months, but gradually rises during the summer, its incidence closely following the curve for temperature. The curve is smooth and regular, and only in communities having infected milk and water supplies do there occur marked and irregular increases at all seasons of the year.[2]

If the health officer is familiar with such basic considerations and keeps a careful watch over the occurrence of cases in his district, he will at once note any considerable irregularity which may be the first signal of an incipient outbreak. For this purpose the records and charts recommended in the early part of the present chapter are adequate, though in the larger cities they may be supplemented by special means, such as a separate chart for milk dealers, etc.[3] On the "spot map" *foci* of contact infection may readily be detected. Since it is the first cases in an epidemic which are of the greatest importance in control, the necessity of constant watchfulness to detect such cases is evident.

INVESTIGATION OF EPIDEMICS

If an epidemic is recognized to be present, a systematic investigation must be made, with the following *objects* in view:[4]

1. To ascertain whether or not the disease is actually present, and if so, whether as a general epidemic or as a local outbreak.
2. To discover the cause.
3. To remove the cause.
4. To prevent further spread of the disease.

[1] See the section on Typhoid Fever.

[2] See Rosenau, "Preventive Medicine and Hygiene, 1913, p. 79.

[3] Such records should of course be considered with reference to the number of customers served by each dealer. The natural chances of occurrence of cases on the routes of dealers supplying various numbers of customers have been worked out in mathematical form by Carpenter ("The Distribution of Cases Among the Several Producers in Epidemics of Non-milk-borne Infectious Disease," *Am. Jour. Pub. Health*, 1912, vol. II, no. 4, p. 296), indicating the number of cases which might be allowed to each of such dealers without suspicion of infection of their supplies.

[4] The following remarks are based largely upon Whipple's "Typhoid Fever," 1908, Chapter IX, on "The Investigation and Control of Typhoid Fever Epidemics." Very much the same principles apply to other diseases.

Collection and Study of Data

These steps involve first of all the collection of *data*, for which purpose a regular form of history card should be used. The data necessary may be obtained in a personal interview in each family where a case has been reported, supplemented, if necessary, by information from physicians' histories. Needless to say, it is assumed that all cases are strictly reported. From the beginning the data are studied with the prime object of discovering a *common cause*. The following remarks sketch the procedure in investigating a typhoid fever epidemic, a procedure which illustrates in a general way the methods followed in investigating other diseases.

As fast as the data are obtained they should be tabulated and studied from various points of view.

Were the cases generally distributed over the city or were they confined to one locality? A convenient method of ascertaining this is to take a street map and locate the cases with black-headed pins stuck in at the place of residence. This map, with its pins, can afterwards be photographed for record. If the cases are localized, does the locality suggest anything as to a common cause? Is it coincident with some particular water supply, as it was in New Haven, or with some milk dealer's territory, as in Somerville? Is it located in a section where there are no sewers, as in Winnipeg? Is it around some public well, as in Newport? Or are the cases merely concentrated in one place because the population is densest there? Does the geographical distribution of the cases change as the epidemic progresses? Where were the early cases with respect to the others?

What was the probable date of infection? Was there a sudden, sharp attack, or was the onset gradual? If the latter was the case, what were the limiting dates of infection? The date of infection has to be estimated by counting back from the time when the patient was taken sick. All things considered, the safest date to count from is that of taking bed. Often this cannot be learned, especially if the investigation is made sometime afterwards. But the date of going to bed is seldom far from the time of the physician's first call, and this can usually be obtained from the doctor's memoranda. If the epidemic is believed to be due to milk, or oysters, or some other cause involving an intense form of infection, the probable date when the patient received the bacilli into his system may be obtained by counting back 7 to 10 days; but if a water infection is suspected, a period of 10 to 15 days will probably give a better estimate. It must be remembered, however, that occasionally the period of incubation may be considerably longer than this.

Sometimes it is necessary to count back from the appearance of some particular symptom, and in that case the attending physician's advice should be obtained as to whether this occurred in the second or third or fourth week of the disease. Sometimes one has to figure back from the date of death. That also is something about which the attending physician should be consulted.

Were there any outbreaks of diarrhœa preceding the typhoid epidemic? When and among whom did they occur?

Were most of the cases among young people and children? If so, this suggests milk as a cause. Did they all or most of them use the same water-supply, or take milk from the same dealer, or food from the same source?

Had the patients been together anywhere, at business or in school, or at some banquet?

In short, was there any common cause where eating or drinking or association might give opportunity for infection? [1]

Special Investigation

In seeking the origin, any possible cause upon which the data clearly cast suspicion should be subjected to special investigation in order to obtain the confirmatory evidence upon which a positive conclusion can be based. Thus, for typhoid fever, the public water supply, if thus suspected, may be specially inspected and analyzed for possible pollution, likewise private or local water supplies. If a milk supply is suspected it may be gone over from farm to consumer, with search for past or present cases of suspicious sickness, especially by the use of Widal tests applied to all persons in any way concerned in the handling of the milk or milk utensils. The milk dealer will usually coöperate if there is danger of his business being stopped, though skill and tact are necessary to obtain reliable statements as to illnesses. Again, a suspected supply of oysters or other shellfish may be investigated. Of course such investigations are not made in a general manner at the beginning of the inquiry, for such would be a needless waste of energy, but only when study of the data points to some particular source of infection. Sometimes it so happens that the source of the epidemic is located — as in some particular milk supply — but the original case itself cannot be identified on account of insufficiency of evidence. In all of this the services of an expert must be relied upon, and the local health officer may frequently require the assistance of the state authorities. In fact it is the part of wisdom to call in such assistance at the very beginning of the epidemic rather than rely upon the limited familiarity with epidemiology which the local health officer usually possesses.

[1] Whipple, *op. cit.*, pp. 219–221.

Removing the Cause — Checking the Epidemic

The cause having been discovered, it remains to remove it. If it be a well or other private water supply, it may be at once permanently closed. If the public supply, then it may be scientifically disinfected (see page 412), this being the best temporary expedient. Otherwise, it may be necessary to publish notices to "boil the water," or to furnish a pure supply by house-to-house delivery. Then steps should be taken to provide a permanent remedy through purification or substitution of the public supply. A water-borne epidemic may bring out the difference between contamination, or pollution, and infection. A water supply may be polluted even for years without apparent evil results, but just as soon as infection gains entrance with the pollution the weak spot becomes disastrously apparent.

If it is a milk supply that is infected, it should be stopped until and unless it be rendered safe. Safety can be obtained only by removal or complete isolation of the case and sterilization, under the supervision of the health authorities, of all utensils used in connection with the milk. No person who has had the disease or whose blood shows a positive Widal should be permitted to take part in the business until repeated examinations of stools and urine are negative (see section on typhoid fever). As a temporary expedient to permit the continued sale of the milk pasteurization, provided it is *efficient*, may be allowed. In this the possibility of the infection of the milk through contaminated bottles or utensils must not be forgotten, hence equal care must be taken in the sterilization of these and in the methods of operation. It may happen that bottles and utensils are infected in handling or through washing in an impure water supply, and bottles may be infected (as has happened in a number of epidemics) at the houses of customers. The permanent remedy is the sterilization of all milk bottles and utensils and the pasteurization of all milk.

If the epidemic is extensive it may be necessary to arrange for special services for the sick in the shape of extra physicians and nurses and perhaps to establish a temporary hospital, for the hospital plays an important part in preventing the contact infection which is favored by poor home conditions. Cheap and effective disinfectants should be distributed free or at cost and their use described and insisted upon. Facilities for making blood tests should be provided. And all cases should be promptly and thoroughly isolated as described under the section on typhoid fever.

> Through it all, a "safe and sane policy" should be consistently pursued. A community afflicted with an . . . epidemic is sometimes almost panic-stricken. Correspondents may fill the public press with their theories, and many foolish things may be said and

> done. What is needed is a strong central authority that for a time can exercise almost autocratic power, and a government and a public opinion that will uphold such authority, and provide all necessary resources. Fortunate, indeed, is the city that has a health officer or health department equipped for such an emergency and a government that will rise to the occasion.[1]

It may be added that care should be taken not to leap to premature conclusions as to the source of an epidemic. The usual procedure is a course of elimination. Thus if the cases are clearly localized and the general water supply is evidently not responsible, then this fact may be publicly announced, while the investigation goes forward in other directions. Again, if the cases are distributed *pro rata* among various milk dealers and it is certain that there is no common milk supply involved, then this fact may be given out. Such elimination plays an important part, not only in the investigation but also in calming the public mind.

Prevention of Future Outbreaks

When the source of the epidemic has been discovered and the situation has been brought under control, the investigation may be rounded out by the collection of data which will have a practical bearing in preventing future outbreaks, through improving and safeguarding water supplies, obtaining increased funds and better methods for sanitary control, and the like. Sometimes useful data may be collected to show the financial damage produced by the epidemic. Thus the Pittsburgh Survey (1908)[2] as the result of its researches estimated the average cost in medical attendance, loss of work, etc., for each case as $125, and $2200 for the fatal cases. The computable value of prevention is illustrated specifically by the following statement bearing on the purification of public water supplies:

> The filtration of a polluted public water supply increases to a very great extent the vital assets of a community, and the increase in most cases is many times greater than the cost of constructing and operating the works. . . . [In Albany, N. Y., for example] the increased worth of the water . . . amounts to $475,000 per year, of which at least $350,000 may be considered as a real increase in the vital assets of the city.[3]

A similar argument might well be made out for the pasteurization of milk supplies or any other sanitary measure. All such expenditures constitute truly, as Whipple remarks, a kind of community life insurance.

[1] Whipple, *op. cit.*, p. 226.

[2] See Whipple, *op. cit.*, Appendix XIV, also p. 275.

[3] Whipple, *op. cit.*, p. 280 f. Cf. "The Value of Pure Water," by the same author.

TYPES AND CHARACTERISTICS OF INFECTION

The health official should have a knowledge of the various types of infection. The following is a sketch of some of the more important points, arranged according to the modes of transmission:

Contact. — Practically any of the communicable diseases, with the exception of those which have an intermediary host, may be spread by contact.[1] The characteristic of contact infection is its straggling appearance. Most of the endemic diseases show this clearly, e.g., scarlet fever, diphtheria, and typhoid fever. To the constant chain of cases of these diseases which are practically always to a greater or less extent present in the community Sedgwick and Winslow have applied the term " prosodemic " (" proceeding through the community "). The principal means of this infection are " food, fingers and flies," all of which in this connection rank as varieties of contact infection. When a disease is spread from person to person rather than through a common medium affecting large numbers of people at once its progress is ordinarily more gradual but more difficult to control. Fairly distinct contact epidemics may, however, occur (see under Examples, below).

Water. — The chief diseases transmitted by water are typhoid fever, gastrointestinal diseases and Asiatic cholera. Epidemics are usually gradual in onset and in decline. If there is simply a single infection of a water supply which quickly ceases, the cases will gradually rise to a maximum and then slowly decline. But if the supply is subject to continual infection the number of cases will tend to stay up, with fluctuations according to the amounts of infecting material present from time to time. A small, continued amount of infection may, however, produce the same sort of effect as contact infection, the cases appearing in a straggling succession. Water-borne typhoid fever epidemics are frequently preceded by a premonitory outbreak of cases of gastro-intestinal disease (the incubation of the latter being shorter); of this, unfortunately, the public health authorities usually have little or no information, though it has been aptly suggested that cases of such sickness should be made reportable.

Milk. — The chief diseases transmitted through milk are typhoid fever, scarlet fever, diphtheria, septic sore throat and tuberculosis (the last is taken up elsewhere and need not be considered here). Milk epidemics are usually, though not always, characterized by suddenness of onset. This is explained by the fact that the dose of infection may be relatively greater than in water supplies but especially that, milk being an excellent culture medium, the germs may multiply greatly in

[1] For definition and discussion see p. 113.

it. The relatively high prevalence among the milk-drinking portion of the population — viz., children — though not invariably well marked, is also characteristic of milk-borne epidemics.

Insects. — Infection by flies and other insects which carry infecting material in a mechanical manner does not produce marked or wide-spread epidemics except under extraordinary circumstances (page 190 f.). The relative amount of such infection is uncertain. Cases would appear according to the prevalence of the insects and the opportunities for infection; thus a part of the increase in typhoid fever during the warmer months is doubtless due to infection by flies. A similar principle applies to malaria and yellow fever, in which the insect (the mosquito) acts as intermediate host of the parasite. These diseases occur according to the prevalence of *anopheles* and *aëdes* (or *stegomyia*) mosquitoes respectively, and according to the opportunities for them to become infected from malaria and yellow fever patients and carriers.

Primary and Secondary Cases. — Distinction should be made between "primary cases" (those due directly to the original source of the epidemic) and "secondary cases" (those contracted from the primary cases in the course of the epidemic or shortly after it). Secondary cases are sometimes called "contact cases," contact being the usual mode of secondary infection. In epidemics due primarily to water, milk, etc., secondary cases should be guarded against, and in reporting epidemics should be included under a separate head.

Epidemic Curve. — As implied above, the character of the epidemic curve when the cases are arranged and plotted in order of time varies. Thus there is the explosive type (frequent in milk-borne epidemics) and the wave-like type, in which the incidence of cases rises gradually to a maximum and gradually declines (frequent in water-borne infection), as well as the straggling appearance of cases which is characteristic of contact infection. The types are thus roughly associated with certain modes of infection; the associations are, however, not at all invariable.

Carriers, Missed Cases, Incipient Cases. — These important classes of cases have been dwelt upon in previous pages. They have, within a few years, been shown greatly to aggravate problems of control and to add an entire new chapter to epidemiology, revolutionizing our views in important respects. A long list might be compiled of epidemics of typhoid fever and diphtheria due to carriers, a list which would be longer and no doubt include other diseases if our knowledge of causes and modes of transmission were more extensive. The study of every epidemic should include a careful consideration of the possibilities of the activity of this class of cases. Even when an epidemic is not due to a carrier or missed case the probability — often the certainty — of the presence

of such cases after the epidemic is under way should be taken into account. Unfortunately, except (chiefly) for typhoid fever and diphtheria, we have no means of laboratory diagnosis for such cases.

EXAMPLES OF EPIDEMICS

No attempt can here be made to sum up the large literature dealing with the details of the various recorded epidemics of different kinds. The following examples, while more or less typical, merely illustrate some of the general principles. It must not be supposed that all epidemics follow just the same course. The details of each require individual study, for all the text-book points are frequently not present and the investigator must be on the alert for the atypical and unexpected.[1] We are not dealing here with hard and fast effects, but with the varied phenomena arising from the interaction of many different factors.

Contact Infection (Typhoid Fever)

The following extract is from the report of Prof. William T. Sedgwick on an epidemic of typhoid fever at Bondsville, Massachusetts, 1892, which was one of the first to direct attention to the importance of contact (at that time called " secondary ") infection.[2] This account, though written over twenty years ago, illustrates clearly what may readily occur today in any community where ordinary unsanitary privies and unclean habits of living exist. After remarking upon the well-water and tap-water theories which the investigator found popularly current on his arrival, he goes on to say:

Consideration of Water Supplies

> It very soon appeared that the cases were by no means synchronous, but showed a peculiar and interesting succession. At the same time other serious objections to any theory of water infection began to appear. In the first place, the tap-water theory was untenable, because (1) although this water was supplied only

[1] For example, in an epidemic of milk-borne typhoid fever investigated by the writer in Essex County, N. J., spread by the medium of infected milk bottles, it was noteworthy that the typical explosive incidence did not occur, for the cases straggled along in much the same manner as contact cases; neither was there the typical incidence among children, for out of 24 cases there was only one case under 15 years of age. Moreover a number of the cases were mild and clinically atypical. (Proceedings 4th Ann. Conf. State and Local Bds. of Health of N. J., 1913, p. 38.) Such atypicalness is not at all infrequent.

[2] 24th Ann. Rpt. State Board of Health of Mass., 1892.

to the small district in which the fever appeared, and to the bleachery (as may be seen by following upon the map the broken line coming from left on Front Street), and was therefore curiously connected with the infected houses, it was plain that but little if any of it had been used for drinking, on account of the prejudice against it referred to above; and (2) because many of the tenements supplied with it, as well as the very populous boarding-house, had been entirely exempt from the fever. So, also, was it with the well-water theory; for, while at first this looked extremely plausible, it was difficult to see, first, how, if the well had been really infected, more cases had not developed, for it was used by everybody; and, second, if it were really infected, why the cases were so strangely successive and not simultaneous. Besides all this, opposed to both theories, was the fact that there was absolutely no evidence of any specific contamination of either tap water or well water in either the near or the remote past. When, therefore, the bacteriological and chemical examinations revealed the fact that both waters were, considering the circumstances, remarkably pure, both theories of water infection necessarily fell to the ground.

Consideration of Milk Supplies

I next made a careful study of the milk supply, which showed that the infected families had several different milkmen. Here, also, the remarkable succession of the cases was a serious objection to the theory, and, finally, the milk theory also, being entirely unsupported by any evidence, had to be abandoned.

Contact Infection[1] the Apparent Solution

In the course of the investigation I had already observed some striking examples of the possible methods of secondary infection in the tenement containing cases 9, 12, 15, 16. Some of the other cases were also plainly secondary, and I therefore made a careful study of the dates of the several cases and of the local sanitary conditions. As a result I was finally forced to conclude that from one imported case, favored by the peculiar constitution of the little community and its habits, the fever had slowly spread by secondary infection, until it finally reached Front Street. The following table will show the succession of cases, and, if this be read in connection with their location upon the map, it may serve

[1] The term "secondary infection," as used in this account, is synonymous with "contact infection."

as an unusually clear and interesting example of the growth of an epidemic of typhoid fever apparently due to secondary infection. It is noteworthy that many of the patients were children.

Number of the case	Date of the case	Number of the case	Date of the case
1	Aug. 1–5	13	Aug. 30
2	11	14	Sept. 3
3	13	15	4
4	13	16	7
5	14	17	12
6	15	18	14
7	16	19	15
8	16	20	16 (?)
9	20	21	20
10	24	22	27
11	26	23	29 (?)
12	27	24	30

How Contact Infection Occurs

The "date of the case" was, as usual, either the date "of going to bed," or, more often, of the "physician's first visit." Some of the victims were French, some Irish; all or nearly all went to the same school and attended the same church. The adults of the two nationalities in this little community live in friendly, but not intimate, relations; the children, on the other hand, play constantly together, and wander freely from house to house; they are at home in all of the houses in which there are any children. On High and Maple streets live about one hundred and fifty people. Children abound; and, as there are no fences, and because it is the custom, they mingle freely, playing together and passing from house to house. The families are of that grade in which food always stands upon the table; meals are irregular except for those who must obey the factory bell. The children play awhile, then visit the privies, and with unwashed hands finger the food upon the table. Then they eat awhile, and return to play. Or, changing the order of things, they play in the dirt and eat and run to the privy, then eat, play and eat again, and this in various houses and in various privies. For them, so long as they are friendly, all things are common — dirt, dinners and privies; and, to illustrate how secondary infection may go on, I may describe in detail one case which I personally witnessed. A whole family (of six or more) was in one room. Four of them had the "fever." Two of these were children in the prodromal stage.

A table stood by the window covered with food, prominent among which was a big piece of cake. It was early September, and a very warm day; but every window was shut and the odor was sickening. Flies innumerable buzzed about, resting, now on the sick people, now on the food. A kind-hearted neighbor was tending the baby. By and by one of the children having the fever withdrew to the privy probably suffering with diarrhœa, but soon returning, slouched over to the food, drove away some of the flies and fingered the cake listlessly, finally breaking off a piece but not eating it. Stirred by this example, another child slid from his seat in a half-stupid way, moved to the table, and, taking the same cake in both hands, bit off a piece and swallowed it. The first boy had not washed his hands, and if the second boy suffered from secondary infection, I could not wonder at it.

This was one case; but I have seen so often the table of food standing, hours long in the kitchen and serving as one station in the dirty round of lives like these, that it is easy for me to understand how dirt, diarrhœa and dinner too often get sadly confused. Personal filth is apparently the principal agent of secondary infection.

Thus far I have not even touched upon one feature of the life of this little community, which deserves careful consideration. There was for most or all of these houses a sewer connection *for the sinks but not for the privies.* Much, perhaps most, of the garbage found its way into the privies. These had been obviously in bad condition, and, from some, filthy streams ran down between them and the houses. In and around these streams the children played. Given any original imported case, the infection might easily have reached these trickling streams. Children's fingers might thence carry the germs to the food, and thus the journey of the germs from one living intestine to another be completed. Or, again, given in such a community an imported case and no disinfection, as was the condition here at first. The importer while in the early stages handles with unclean hands food for others; or the clothing of such a person gets infected and is handled; there need be then no difficulty in completing the history. It follows as a matter of course.

Water-borne Typhoid Fever

(*Plymouth, Pa.*)[1]

Original reference to this epidemic: 1st Ann. Rpt. State Board of Health and Vital Statistics of Pennsylvania, 1886, pp. 176–195.

[1] From Whipple's "Typhoid Fever," 1908, pp. 136–140. This work contains accounts of typhoid epidemics of all the various types.

Among the typhoid fever epidemics which have occurred in America that at Plymouth, Pa., deserves first mention, partly for the reason that it was one of the first large epidemics where the cause was definitely ascertained, and partly because of the influence which the lessons taught by it have had on sanitary science in this country.

The epidemic occurred in the spring of 1885. Plymouth at that time was a mining town of about 8000 inhabitants. It had a public water-supply derived from a stream which drained an almost uninhabited water-shed, and the water was stored in a series of four small reservoirs. The highest of these reservoirs had a capacity of 5,000,000 gallons; the next, 3,000,000; the next, 1,700,000; and the lowest, nearest the city and used as a distributing reservoir, 300,000 gallons. This water-supply, though apparently satisfactory in quality, was not sufficient at all times for the needs of the city, and occasionally it was necessary to supplement it by pumping from the Susquehanna River. Well waters were also used by some of the inhabitants. As it turned out, neither the well water nor the polluted Susquehanna water played any part in the epidemic, which, through the efforts of Dr. L. H. Taylor of Wilkesbarre, and others, was found to have been caused by the "pure mountain stream" supply of the Plymouth Water Company.

It is unnecessary to follow here all the steps by which the epidemic was traced to its origin; it will be simpler to recite the pertinent events chronologically, and this will also indicate more clearly the relation between cause and effect.

The Original Case

In an open clearing near the banks of the stream and just below the upper reservoir, there existed one of the few houses on the water-shed. The man who occupied this house went to Philadelphia on Dec. 24, 1884, and on Jan. 2, 1885, returned home ill with typhoid fever. It was a severe case. The patient was in bed for many weeks. By the first of March he was convalescent, but a relapse occurred, and it was the middle of April before the physician's visits were discontinued. "During the course of his illness, his night dejecta were thrown without disinfection upon the snow and frozen ground, toward and within a few feet of the edge of the high bank which sloped precipitously down to the stream supplying the town with water. . . . The dejecta passed during the day were emptied into a privy a little farther back, the contents of which lay almost upon the surface of the ground,

so that at the first thaw or rain they too would pass down the sloping bank and into the stream."

Until the latter part of March the ground remained frozen and covered with snow, and under these conditions it is improbable that the dejecta reached the water of the stream. But during the last week in March there was a thaw, the air temperature increased rapidly until, on April 4, the maximum was 70 degrees. During these few days of warm weather the accumulated dejecta of many weeks probably found their way into the stream which supplied the town with water.

Infection of Public Water Supply

On the evening of March 26, the superintendent of the water company visited the reservoirs and found that the two lower ones were almost empty, while the one just below the house where the typhoid patient lived was filling rapidly. He found, however, that the short pipe which allowed the water to discharge from the bottom of this reservoir into the stream leading to the reservoir below it was frozen, and he caused a fire to be built to melt the ice in the pipe. This done, the water flowed from the bottom of this reservoir down through the two reservoirs below it, and thence into the town, where in all probability it first arrived some time between March 28 and April 4 or 5 — that is, from two days to a week after it was let down from the third reservoir.

Magnitude and Lessons of the Epidemic

The first case of typhoid fever in the town occurred on April 9, and from this time on the disease spread rapidly. During the week beginning April 12, from 50 to 100 new cases appeared daily, and it is said that on one day 200 new cases were reported. All classes of people were attacked in all parts of the town, until, before the epidemic ceased, out of the 8000 inhabitants, 1104 contracted the disease, and 114 died.

This epidemic, as Dr. Taylor said in his report, "was one of the most remarkable ones in the history of typhoid fever, and taught important lessons, though at a fearful cost. One is, that in any case of typhoid fever, no matter how mild, or how far removed from the haunts of men, the greatest possible care should be exercised in thoroughly disinfecting the poisonous stools. The origin of all this sorrow and desolation occurred miles away on the mountain side, far removed from the populous town, and in a solitary house situated upon the banks of a swift-running stream. The attending physician did not know that this stream supplied the

reservoirs with drinking-water. Here, if at any place, it might seem excusable to take less than ordinary precautions; but the sequel shows that in every case the most rigid attention to detail in destroying these poisonous germs should be enjoined upon nurses and others in charge of typhoid fever patients, while the history of this epidemic will but add another to the list of such histories which should serve to impress medical men, at least, with the great necessity for perfect cleanliness — a lesson which mankind at large is slow to learn."

The epidemic is interesting to bacteriologists from the fact that it throws some light upon the ability of the typhoid bacillus to survive the apparently unfavorable conditions of winter. Some of the bacilli at least must have lived and retained their virulence in the frozen fecal matter for many weeks.

The financial loss in this epidemic has been estimated at more than half a million dollars.[1]

Milk-borne Scarlet Fever

(*Norwalk, Conn.*)[2]

In November, 1897, an unusual number of cases of scarlet fever occurred in Norwalk. Population of Norwalk, South Norwalk and East Norwalk, 22,000. Previous to October 25 scarlet fever had been reported as follows: August, no cases; September, 5 cases; October 10, one case. The source of infection in most of these cases had been traced.

Number and Distribution of Cases

Between October 25 and November 9, 29 cases developed. The 29 cases were distributed in 25 families and 24 houses. School infection was eliminated. Many cases did not attend school, and some were in families where they had no school children. The cases were widely separated; 17 of the infected houses were in South Norwalk, 3 in Norwalk and 4 in East Norwalk. The families were of different social positions and contact-infection seemed improbable. The only factor in common to practically all of the cases was the milk supply. Twenty-seven out of the 29

[1] Dr. M. S. French, quoted by Sedgwick in "Sanitary Science and Public Health."

[2] Account and diagram taken from Trask, in "Milk and Its Relation to the Public Health," Bull. 56, Hyg. Lab. of U. S. Public Health Service, 1909, pp. 33, 34. Original reference: Smith (Herbert E.), Rpt. Connecticut State Board of Health, 1897, p. 259.

obtained milk from one dealer, H. The other two were in one family in East Norwalk; they were a girl of 12 and a boy of 9 years, and were taken ill on November 7 and 9, respectively. They had no connection with the milk route, nor could their infection be traced to any source.

The estimated daily supply of milk in Norwalk was 3500 quarts. Dealer H furnished 450 quarts, or about one-eighth of the whole, whereas he had twenty-seven twenty-ninths of the scarlet fever cases on his route.

How Milk Became Infected

H bought his milk from three producers. There were no cases of disease in the family of the milk dealer nor in those of two of the producers, A and B, but on the third producing farm, K, a case of scarlet fever was found. This farm was in the Bald Hill district. The district school had opened September 7 with a registration of 23 pupils. On September 20 one of the pupils fell ill with scarlet fever; other cases followed, and the school was closed October 19. In all there were 20 cases, all in school children or in those coming in contact with them. Two of the above cases, living near farm K, were exceedingly mild and frequently visited and played at this farm with K's son, a lad of 4 years. This son broke out with a scarlatinous rash October 24.

Milk from this farm was carted to Norwalk and all of it sold to, and delivered by, dealer H, who placed the cans of milk from K in his wagons with that from the other two producers, A and B. No attempt was made to keep the cans separate, and, therefore, one day part of his customers might receive K's milk and the next day it would be delivered to others. H supplied about 300 families, of which 24 were invaded. The sale of this milk was stopped November 7. The number of cases and the dates on which they

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Explanation of Chart 3

A, B and K are dairy farms selling their product to retail milk dealer H. K is the farm on which a case of scarlet fever occurred antedating the outbreak in Norwalk.

The large square T O W N represents the city of Norwalk.

H is the retail milk dealer among whose customers all cases but two occurred. The dash lines represent H's milk route, and each dot is a case of scarlet fever.

C, D, E, F, G, I and J are other dairymen having routes in Norwalk. The lines extending from them into the city represent their milk routes and are introduced to show their freedom from the disease.

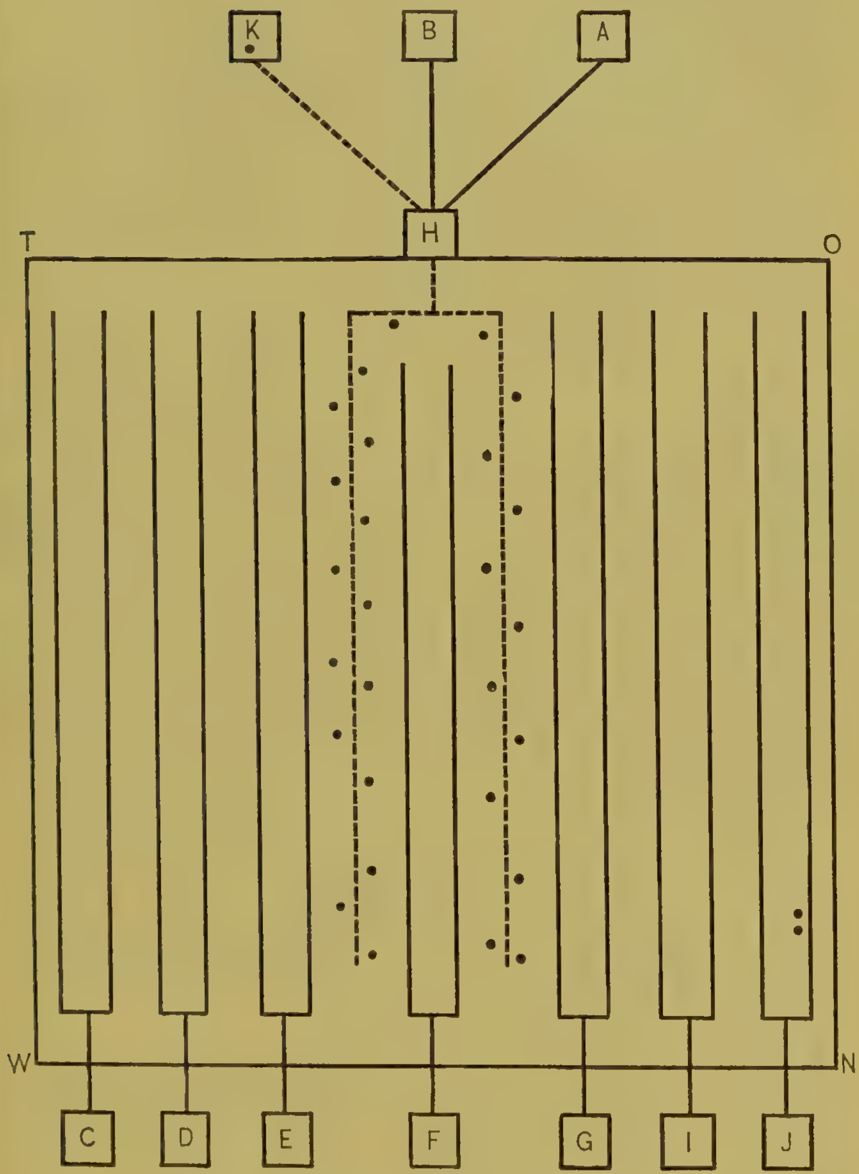

CHART 3.

(From Trask)

Showing Relation of Milk Routes to Scarlet Fever Cases During Outbreak at Norwalk, Conn., 1897. (For explanation see p. 282.)

occurred would indicate that the milk was not continuously infected. During the outbreak several cases of sore throat occurred among users of H's milk, which may possibly have had some casual relation to the infectious milk. [See Chart 3.]

It would seem that cases of scarlet fever belonging to the school outbreak and visiting the dairy farm, and possibly also the boy on the farm, infected from his playmates, were the source or sources rendering the milk infective. The relation here of the two outbreaks is of interest, the one spread by school contact being the original source of the milk epidemic.

Shellfish Infection (Typhoid Fever)

The chief example of an epidemic due to infected shellfish is that of Middletown, Conn. Between October 20 and November 9 there occurred among persons connected with Wesleyan University at Middletown 25 cases of typhoid fever, 4 of which proved fatal. The epidemic was investigated by Dr. H. W. Conn, who found that the persons in question had taken part in banquets held October 12, where the only article of food common to the cases was oysters taken from a certain source. On tracing these oysters back it was found that they had been "floated" (i.e., placed to fatten in brackish water) in the water of a sewage-polluted estuary. It was therefore concluded that this was the source of the epidemic. It was estimated that 25 per cent of those who partook of the dinners were made ill with typhoid fever or intestinal disorder.[1]

Milk-borne Infection Due to a Carrier (Typhoid Fever)
(*New York City*)[2]

Early in February, 1910, our attention was arrested by the fact that on one day nine cases of typhoid fever were reported from a

[1] See Whipple, "Typhoid Fever," 1908.

[2] Bolduan and Noble, "A Localized Outbreak of Typhoid Fever Traced to Milk Infected by a Bacillus Carrier; also a Case of Laboratory Typhoid Fever Contracted from the Cultures," *N. Y. Med. Jour.*, 1912 (reprint of Dept. of Health of the City of New York). (Italics are those of present author.) Cf. account by same authors: "A Typhoid Bacillus-Carrier of Forty-Six Years' Standing, and a Large Outbreak of Milk-borne Typhoid Fever Traced to This Source," *Jour. Am. Med. Assn.*, Jan. 6, 1912, vol. lviii, pp. 7–9 (reprinted by N. Y. City Dept. of Health); also H. W. Hill, "All the Typhoid of a Community for Five Years from a Carrier through Milk," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 8, p. 667.

small district on the upper West Side (Borough of Manhattan). Four of the cases were in 149th Street, two in 122nd Street and the rest in the section between. The following day six additional cases were reported from this district, and after this, for several weeks, each day brought more cases to light. Careful investigations were at once instituted and these showed:

1. That the outbreak was confined to a comparatively small part of the city.

2. That practically all of the patients had been supplied with milk from one particular milk company.

3. That with the exception of the municipal water supply, no other factor than milk was common to all of the cases.

4. That the date of onset in most of the cases was the last week in January.

The localized character of the outbreak at once excluded the water supply as the source of the infection. The milk in question was supplied by one of the large milk companies, and was almost all obtained in the northern part of New York State in the vicinity of Lake Champlain and from the adjacent part of Vermont. All this milk was bottled in the country and was raw milk. Several inspectors were at once ordered by telegraph to investigate the various creameries which had shipped milk to the infected district during January, and it was found that in P———, where one of the creameries was located, a series of six cases of typhoid fever had suddenly appeared practically simultaneously with the cases being studied in New York City.

Meanwhile additional cases were being reported in the city from the district mentioned on the upper West Side, and almost all the patients were found to be users of the suspected milk. The few exceptions proved, in one or two instances, to be cases incorrectly diagnosticated as typhoid fever, in other instances cases contracted out of town. It is probable that some of the later cases were secondarily infected, though no connection with previous cases could be discovered. The total number of cases belonging to the outbreak was forty-four.

It is well known that in outbreaks of typhoid fever due to milk infections a large proportion of children are attacked. This was true of the present outbreak, as can be seen from the following table showing the age distribution of the cases:

5 years and under	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	Over 30	Total
6	6	4	8	11	4	5	44

Plotting the dates of onset in the form of a curve, as has been done in the chart, we get the impression that the infecting agent

operated several times. While we have been unable to prove that the milk was thus repeatedly infected, it is suggestive to note that the onsets of the P——— cases were:

January 20th — one case.
January 24th — one case.
February 1st — three cases.
February 7th — one case.

Returning now to the P——— cases, it was found that the six cases occurred in homes supplied, in each instance, with milk from the shipping station, " creamery," in question. This is particularly important because no milk is allowed to be sold from the creamery for local consumption. The employees of the creamery, however, have been allowed to supply their households at wholesale prices, and the infected households were each of them thus supplied.

Discovery of Original Case (Carrier)

There was no question, therefore, that the milk shipped from P——— was the cause of the New York city outbreak, and accordingly orders were issued prohibiting further shipments from that creamery. Meantime, careful investigations were made in order to discover the ultimate cause of the infection. The creamery was carefully inspected and all the employees were interrogated in their homes. Each of the forty-five dairies sending milk to this creamery was visited, and all members of the household including the help were questioned as to a possible typhoid infection; a large number of blood tests were made on all who gave a history of recent illness, no matter of what nature; in short, every conceivable source of infection was thoroughly investigated. The result was the discovery of a dairy farmer who gave a history of six cases of typhoid fever on his farm in 1904, one case in 1907, and one case in 1908. The dairyman represented the last of the six cases in 1904, and was now the only person on the farm who had had the disease. Specimens of his stools were collected and examined for typhoid bacilli. The examinations disclosed the presence of enormous numbers of living typhoid bacilli; in other words, the man was a " bacillus carrier." Needless to say, the bacilli were tested with typhoid agglutinating serum and also as to their cultural characteristics. They proved to be typical, as can be seen from an examination of the laboratory data below. The order excluding the milk was thereupon modified to apply only to milk from this one dairy, and regular shipments from the creamery were resumed. In view of all the circumstances mentioned, the fact that no more cases developed, except during the

incubation period, after the milk was stopped, and that no cases occurred after the creamery was allowed to resume shipments, it is evident that this carrier constituted the source of infection.

. . . .

Intermittent Carriage of Germs

A number of questions at once arise. Since the dairy farmer had been sending milk to the P——— creamery regularly during the previous two years, why did not the P——— milk show evidences of typhoid infection prior to the present outbreak? How did the milk actually become infected from the stools of the dairy farmer? How can such infections be guarded against?

In considering the first of these questions, it is important to remember that recent bacteriological investigations have shown that germ carriers may be divided into two classes, chronic and intermittent. In the latter the bacilli may often be absent for considerable periods at a time, only to reappear in undiminished numbers at a later time. Even in the chronic germ carriers, if repeated examinations are made, the bacilli may be present at one time and absent another. This is well shown in the report on repeated examinations of the well-known typhoid carrier, "Typhoid Mary," who was under observation for some three years.[1] The carrier whom we discovered in P——— was apparently one of the intermittent variety, for we were subsequently informed that following our report concerning the finding of typhoid bacilli in the fæces, sixteen specimens were sent to another laboratory and no typhoid bacilli found. In fact this led to our identification of the bacilli being questioned, but, as has already been shown, we were able to confirm our findings most conclusively in an unexpected manner. Another and perhaps the main factor in determining the frequency with which a typhoid bacillus carrier will infect the things he handles, lies in the degree of personal cleanliness of the individual.

It was impossible to discover how the milk was actually infected. The construction of the dairy barn, the water supply, location of privy and cesspool were all satisfactory. Moreover, it is unnecessary to trace the path of the typhoid bacilli from the carrier's intestinal tract to the milk sent to the creamery. *No matter how cleanly in his habits, such a germ carrier on a dairy*

[1] Noble and Pratt, *Collected Studies from the Research Laboratory, Department of Health, City of New York*, iv, p. 188, 1908–1909.

farm is always a menace;[1] sooner or later, through some oversight the necessary combination of circumstances presents itself and infection of others occurs. *How Can Such Infections be Guarded Against?*

The answer to this last question is extremely difficult. [The author then states the impossibility of examining the excreta of the large number of individuals engaged in handling the milk shipped into New York City in order to detect bacillus carriers.] Some advance will be made when every person who has been known to have had typhoid fever and who is engaged in producing or handling milk must undergo the necessary bacteriological examinations in order to prove that he is not a bacillus carrier. In engaging dairy and creamery help, or other persons coming into contact with milk sold to the public, inquiry concerning a previous history of typhoid fever should be made and action taken accordingly. It may be found feasible to enforce some such requirements for the exclusion of bacillus carriers from the dairy industry in the case of the better grades of milk, those selling at retail for 12 cents a quart and more. *So far as the ordinary milk is concerned, however, . . . it seems impossible to guard against this form of infection in any other way than by efficient pasteurization.*

Milk-borne Septic Sore Throat

In recent years a number of epidemics of tonsillitis or septic sore throat have been reported and in some instances very carefully worked out. Unfortunately the conclusions as to the origin of these outbreaks have not been unanimous or positive. There is evidence to indicate that they are due to inflammatory conditions of the udders of dairy cows, but the identity of the bacteria found in such conditions and those found in the throats of the victims has not been conclusively established; and on the other hand there is reason for suspecting human carriers of the pathogenic organism.

An extensive epidemic in Boston and environs was investigated by Winslow.[2] 1043 cases were studied. The epidemic was explosive in character, the majority of cases occurring within a week. The cases followed one particular milk supply. Cases of septic sore throat were numerous in the region from which this supply was derived. No

[1] Bolduan and Noble, *Journal of the American Medical Association*, lviii, 1912.

[2] Winslow, "An Outbreak of Tonsillitis or Septic Sore Throat in Eastern Massachusetts, and Its Relation to an Infected Milk Supply," *Jour. Inf. Diseases*, 1912, vol. x, no. 1, p. 73.

record was obtained of any well-defined case of tonsillitis in direct contact with the milk, but it was concluded on the circumstantial evidence that the actual infection was due to a carrier case. No cattle disease was known to have occurred on any of the farms. The supply was clean and carefully handled. The investigator concludes that even a most carefully supervised supply is open to the danger of grave infection from carrier or unrecognized cases of disease, and puts forth as "the only real safeguard against such catastrophes" "pasteurization, carried out by the holding system and preferably in the final packages."

In February and March, 1912, there occurred in Baltimore an epidemic of "throat infection associated with or followed by one or more of the following conditions: cervical adenitis, septicæmia, peritonitis, and erysipelas. Bacteriological examinations were made of the milk supply involved, of the milk at the farms and of the throats of employees and cases. The milk had been supposedly pasteurized by the flash process (stated as 158° to 165° F. for 2½ to 5 minutes), but this proved to have been inefficient. In the various bacteriological examinations the following organisms were found: diplococcus pneumoniæ, streptococcus epidemicus (few) and streptococcus pyogenes. From these examinations[1] the investigator draws a reasonable certainty "that the outbreak . . . was largely due to milk that had not been thoroughly pasteurized."

Epidemics have also been reported from Chicago, Homer and Cortland (N. Y.),[2] and other places in this country. Numerous outbreaks have occurred in Great Britain and have been clearly traced to infected milk supplies. Septic sore throat is therefore by no means rare as a milk-borne infection and is one of the serious dangers that surround a raw milk supply.

SUMMARY OF MILK-BORNE EPIDEMICS

As illustrating the more common *ways* in which milk may be infected the following summary[3] is of interest.

> Of the 179 typhoid epidemics reported as spread by milk, compiled by the writer, . . . all cases enumerated in the outbreak were reported as living in houses supplied with the suspected milk in

[1] Hachtel, "Bacteriological Investigation of an Outbreak of Septic Sore Throat in Baltimore" (Abstract), *Am. Jour. Pub. Health*, 1913, vol. iii, no. 8, p. 780. The epidemic was also studied by officials of the U. S. Public Health Service.

[2] *Jour. Inf. Diseases*, Jan., 1914; and Rpt. of N. Y. Milk Committee for 1913, p. 30.

[3] Trask, in Bull. 56, Hyg. Lab. U. S. Pub. Health Service, 1909.

96 of the epidemics; a case, suffering from the disease at such a time as to have been the possible source of infection, was found at the producing farm, distributing dairy or milk shop in 113 cases; the outbreak was supposed to have been due to bottles returned from infected households and refilled and distributed without previous sterilization in 4 cases.

Of the 23 diphtheria epidemics reported as spread by milk . . . cases of the diseases occurred at the producing farm, distributing dairy or milk shop at such a time as to have been the possible cause of the outbreak in 18 cases; the diseased person milked the cows in 4; the same person nursed the sick and handled the milk in 1; the outbreak was supposed to be due to disease of the cows in 2; all cases of the disease were reported as living in households supplied with the suspected milk in 15 instances; measures taken upon the presumption that milk was the carrier of infection were reported as followed by subsidence of the outbreak in 5 cases; the Klebs-Loeffler bacillus was isolated from the suspected milk in 2 of the epidemics.

Of the 51 scarlet fever epidemics reported as spread by milk, compiled by the writer, . . . all cases enumerated in the outbreak were reported as living in houses supplied with the suspected milk in 27 of the epidemics; a case suffering from the disease at such a time as to have been the possible source of infection was found at the producing farm, the distributing dairy or milk shop in 35 cases; the outbreak was supposed to have been due to bottles returned from infected households and refilled without previous sterilization in 3 cases; the diseased person or persons were mentioned as handling the milk or milk utensils in 3; the sick milked the cows in 12; the same person nursed the sick and handled the milk in 1; same person nursed sick and milked cows in 1; the outbreak was supposed to be due to disease of the cow in 2; it was reported that measures taken upon the presumption that milk was the cause of the epidemic were followed by abatement of the outbreak in 22 cases.

In 138 epidemics of milk-borne typhoid fever collected by Busey and Kober the following data are given:[1]

In 109 instances there is evidence of the disease having prevailed at the farm or dairy. In 54 epidemics the poison reached the milk by soakage of the germs into the well water with which the utensils were washed and in 13 of these instances the intentional dilution with polluted water is admitted. In 6 instances the infection is attributed to the cows drinking or wading in sewage-polluted water.

[1] Quoted by Trask, *loc. cit.*

In three instances the infection was spread in ice cream prepared on infected premises. In 21 instances the dairy employees also acted as nurses. In 6 instances the patients while suffering from a mild attack of enteric fever, or during the first week or ten days of their illness continued at work and those of us who are familiar with the personal habits of the average dairy boy will have no difficulty in surmising the manner of direct digital infection. In one instance the milk tins were washed with the same dishcloth used among the fever patients. In one instance the disease was attributed to an abscess of the udder, in another to a teat eruption, and in no. 81 to a febrile disorder in the cows. Nos. 85, 103, 120, and 127 were creamery cases. In no. 96 the milk had been kept in the sick room.

In 28 epidemics of milk-borne diphtheria collected by the same authorities, the following:

In 10 instances diphtheria existed at the farm or dairy, and in 10 instances the disease is attributed directly to the cows having garget, chapped and ulcerative affections of the teats and udder, while in no. 13 the cows were apparently healthy but the calves had diarrhœa. In no. 23 one of the dairy maids suffered from a sore throat of an erysipelatous character, and in no. 27 the patient continued to milk while suffering from diphtheria. In no. 28 one of the drivers of the dairy wagons was suffering from a sore throat.

And in 74 epidemics of milk-borne scarlet fever, the following:

In 41 instances the disease prevailed either at the milk farm or dairy. In 6 instances persons connected with the dairy either lodged in or had visited infected houses. In no. 12 the milkman had taken his can into an infected house. In 20 instances the infection was attributed to disease among the milch cows; in 4 of these the puerperal condition of the animal is blamed. In 9 instances disease of the udder or teats was found. In one instance the veterinarian diagnosed a case of bovine tuberculosis. In 6 instances there was loss of hair and casting of the skin in the animal. In no. 68 the cattle were found to be suffering more or less from febrile disturbance. In 10 instances the infection was doubtless conveyed by persons connected with the milk business, while suffering or recovering from an attack of the disease, and in at least 8 cases by persons who also acted as nurses. In three instances the milk had been kept in the cottage close to the sick room. In no. 15 the cows were milked into an open tin can which was carried across an open yard past an infected house, and in no. 53 the milkman had wiped his cans with white flannel cloths (presumably infected) which had been left in his barn by a peddler.

Nos. 21 and 44 appear to have been instances of mixed infection of scarlet fever and diphtheria.

It may be added that experience has shown that good general sanitary conditions by no means necessarily protect a milk supply if a source of infection is present.

Points of Interest in Reporting Milk Epidemics[1]

In reporting milk epidemics some of the points of special interest are the following:

1. The number of cases of the disease existing in the involved territory during the time covered by the epidemic.
2. The number of houses invaded by the disease.
3. The number of invaded houses supplied in whole or in part, directly or indirectly, by the suspected milk.
4. The number of cases occurring in invaded houses so supplied.
5. The number of houses supplied with the suspected milk.
6. The relative proportion of houses so supplied to those supplied by other dairies.
7. The time covered by the epidemic.
8. The location of the case or cases from which the milk became contaminated.
9. The relation of the original case to the milk.
10. The time relation of the original case to the epidemic.
11. The special incidence of the disease among milk drinkers.
12. The elimination of other common carriers of infection.
13. The effect upon the epidemic of closing the dairy or taking such measures as will eliminate possibility of milk contamination from the suspected focus.
14. The finding of the specific organism in the milk.

REFERENCES ON EPIDEMIOLOGY

The literature of epidemiology is voluminous and scattered through a great variety of text-books and periodicals. For special reference to the epidemiology of milk see "Milk and Its Relation to the Public Health" (Bull. 56, Hygienic Laboratory, U. S. Public Health Service, 1909), in which Trask has summarized the subject; also the references on milk in the present volume; also "The Dissemination of Disease by Dairy Products, and Methods of Prevention," Circular 153, Bureau of Animal Industry, Department of Agriculture, 1910. Whipple has treated the subject of typhoid fever epidemiology in full in his "Typhoid Fever," 1908. The Reports on "Typhoid Fever in the District of

[1] Trask, *loc. cit.*

Columbia" (Bulletins of the Hygienic Laboratory, Public Health Service) also contain a large amount of useful information.

GENERAL REFERENCES ON COMMUNICABLE DISEASE

No attempt can here be made to give a complete list. The following, however, may be mentioned among works dealing with the administrative aspects of communicable disease:

Rosenau, " Preventive Medicine and Hygiene," Appleton, New York, 1913. (A comprehensive treatise which has been used as the authority for many of the statements in the foregoing chapter.)

Chapin, " The Sources and Modes of Infection," Wiley and Sons, Inc., New York, 1912.

Doty, " Prevention of Infectious Disease," Appleton, 1911.

Kerr and Moll, " Communicable Diseases: An Analysis of the Laws and Regulations for the Control thereof in force in the United States," Pub. Health Bull., no. 62, U. S. Pub. Health Service, July, 1913.

Reports of the Committee of the American Public Health Association on the Study and Prevention of Communicable Diseases, *Am. Jour. Pub. Health*, 1912 (vol. II, no. 2), 1913 (vol. III, no. 4), 1914 (vol. IV, no. 3) *et seq.;* and of special committees appointed from time to time. The Mass. Assn. of Boards of Health has a committee with similar object (report in *Am. Jour. Pub. Health*, 1914, vol. IV, no. 4, p. 334).

Various papers in *Transactions* of the XV International Congress on Hygiene and Demography, 1912, Government Printing Office, Washington, 1913.

TABLE

IMPORTANT DATA CONCERNING SOME

Disease	Causative organism	Infection exists in	Chief modes of transmission	Incubation period
Diphtheria	*Bacillus diphtheriæ* (Klebs-Loeffler)	Secretions from nose and throat.[1]	Contact, ingesta (especially milk).	2 to 7 days, oftenest 2.
Scarlet fever	Unknown	Secretions from nose and throat[1] (apparently not in desquamation).	ditto.	1 to 7 days, oftenest 2 to 4.
Measles	Unknown	Secretions from nose and throat (in desquamation?).	Contact.	9 to 11 days, possibly 14.
Whooping cough	*Bacillus pertussis* (Bordet-Gengou)	Secretions from nose and throat.	ditto.	7 to 14 days.
Tuberculosis	*Bacillus tuberculosis*	Sputum (pulmonary form), discharges from lesions (other forms).	Contact, ingesta (especially milk), (dust).	....
Typhoid fever	*Bacillus typhosus*[2]	Excreta (stools and urine).	Contact, ingesta (especially water and milk), flies.	8 to 23 days, oftenest 2 weeks.
Smallpox	Unknown	Probably all discharges and secretions, and desquamation.	Contact.	8 to 20 days, oftenest 12.
Acute anterior poliomyelitis (Infantile paralysis)	Unknown	Secretions from nose and throat, also apparently in blood.	Contact, bite of the stable-fly (*stomoxys calcitrans*). Other modes (?)[4]	Unknown
Cerebrospinal fever	*Meningococcus*[3]	Secretions from nose and throat.	Contact.	Unknown.
Rabies	Unknown	Nervous system and saliva of infected animal.	Bite of rabid animal.	See text.

[1] And discharges from lesions in other parts, such as ear, etc.
[2] Termed also *B. typhi*.
[3] Termed also *Diplococcus intracellularis meningitidis* (Weichselbaum).

III

OF THE CHIEF COMMUNICABLE DISEASES

How long infective [5]	Chief restrictive measures	
	Applied to patient	Applied to community
Until germs disappear (two consecutive negative cultures from nose and throat, 24 hrs. apart).	Isolation, with disinfection of infectious secretions. Immunization of contacts (antitoxin).	Lessening of opportunities for contact infection from carriers, incipient cases, and missed cases. Protection of food supplies (pasteurization of milk, etc.).
Until recovery, including disappearance of discharges. Minimum 4 weeks. Desquamation no indication.	Isolation, with disinfection of infectious secretions.	ditto.
Until complete recovery. Minimum 10 days following appearance of rash.	Modified isolation.	Lessening of opportunities for contact infection (incipient and missed cases, etc.). Early discovery and reporting of cases.
Until complete recovery.	ditto.	ditto.
Until germs disappear from sputum or other discharge.	Care of sputum. If necessary more or less isolation. Furtherance of cure.	Attention to housing, factory hygiene, modes of living, etc. Lessening of opportunities for contact infection. Tuberculin-testing of dairy cattle, or pasteurization of milk. Protection of food supplies from infection.
Until germs disappear from stools and urine (usually during convalescence, 5 or 6 weeks after onset).	Isolation, with disinfection of stools and urine. Anti-typhoid inoculation of exposed persons.	Lessening of opportunities for contact infection (carriers, etc.). Protection of food and water supplies (pasteurization of milk). Anti-typhoid inoculation under special conditions of exposure.
Until recovery, desquamation and healing of scars complete.	Isolation, with disinfection of discharges and secretions.[6] Vaccination of contacts and exposed persons.	Vaccination.
Until some time after recovery from acute symptoms, exact time not known.	Isolation, with disinfection of secretions. Screening against flies. Use of 1 per cent hydrogen peroxide gargles, sprays, and nose washes by patient, nurse, physician, and other exposed persons.	Lessening of opportunities for contact infection (carriers, etc.). Reduction of stable flies. Use of antiseptic gargles, sprays, etc., in epidemics.
Until disappearance of germs.	Treatment of patient with anti-meningitis serum. Isolation, with disinfection of secretions. Use of antiseptic gargles and nasal douches and immunization by killed cultures, for exposed persons.	Lessening of opportunities for contact infection (carriers, etc.). Use of antiseptic gargles, sprays, etc., in epidemics.
Until death of animal.	Pasteur treatment.	Regulation of keeping of dogs and destruction of ownerless dogs.

[4] Transmission imperfectly understood.
[5] Opinion varies. Cf. discussions in text; also periods given on p. 633.
[6] Carbolic acid and coal-tars probably not effective in disinfection.

CHAPTER II

CHILD HYGIENE

A progressive department of health cannot long overlook the necessity for work directed toward the conservation of child life. When it is considered that approximately one-fourth of the total mortality in municipalities is made up of the mortality in children under five years of age, the importance of work along these lines can scarcely be overestimated, and a Bureau of Child Hygiene is a necessary adjunct to a well-organized Health Department.[1]

The term "child hygiene" is applied in a general way to all public health work having for its purpose the protection of children from birth up through school age. Its most important division is that of infant hygiene, which applies chiefly to the care of infants under two years of age, and to which special attention will be devoted in the present chapter.

MEDICAL INSPECTION AND SANITATION OF SCHOOLS

Medical inspection of school children, as already remarked in Chapter I, has two objects: (1) the general physical welfare of each child; and (2) the detection and exclusion of communicable disease from the schools. The latter division of the subject was discussed in that chapter, leaving the former division, which consumes the greater labor and expense, to be considered in the following general discussion of the whole matter.

The importance of school hygiene in the broadest sense, including medical inspection, upon the health and develop-

[1] Rpt. of Committee on Organization and Functions of Municipal Health Departments, of the American Public Health Association, 1912.

ment of the child all during the school-going age, requires no amplification here. As to medical inspection, either of the objects above-mentioned is a sufficient reason for its institution.

Leaving, then, the subject of detection of communicable disease as having been outlined under that head, we consider here more especially the function of medical inspection in securing the general physical welfare of the school child. This consists, briefly, in detecting physical defects and non-communicable diseases in the child and seeing that these are remedied. Defects of nose, throat, eyes, teeth, ears and other physical deficiencies and handicaps are the subjects of medical inspection, which by detecting them and causing their removal confers great present and future benefits upon the growing child, to whom, frequently, little attention in these respects is paid by parents.

For adequate medical inspection both doctors and nurses are necessary. The school nurse plays an indispensable part, not only in assisting the medical inspector in his examinations, but also in following up cases and seeing that they receive the necessary home and medical treatment and (if the child has been excluded) are returned to school at the earliest possible time.

Control of Medical Inspection. — There is frequently a question as to the control of medical inspection: should it be under the health or under the school authorities? The laws on the subject vary. There are advantages in having everything within the school walls under the control of the school authorities. On the other hand, if there is medical inspection of parochial and private schools, it must be managed by the health department and it may then be best to have the whole system, including public school inspection, under its control. Local circumstances and laws must decide the question. Where medical inspection includes, as it should, inspection for physical defects as well as for communicable disease, it is frequently

under the control of the educational authorities, although it may properly be initiated and controlled by the health authorities where they are progressive and local circumstances place the responsibility upon them.[1] Control by the health authorities is recommended by the special committee of the American Public Health Association (recommendations below).

Recommendations of the Committee of the American Public Health Association on Medical Inspection of Schools and School Children.[2]

First, that a system of medical inspection of schools be established in every city.

Second, that the control of the same be under the board of health.

Third, that the work include the exclusion of cases of contagious diseases and the recommendation of the correction of physical defects.

Fourth, that dental inspection be part of the system and that the inspection be made by dentists in the employ of the board of health, and that a free dental clinic or clinics under the control of the board of health be established for the care of children unable to pay.

Fifth, that all physical examinations except those for defective teeth be made by physicians and not by teachers or nurses, and that dental examinations be made by dentists.

Sixth, that the maximum number of pupils under supervision of one doctor and one nurse be 3000, and that the number be reduced as much as possible. It would be better to have one nurse for each 1500 pupils.

Seventh, that clinics be established under the control of boards of health for the purpose of correcting the physical defects found in school children.

Eighth, that nurses be required to devote their whole time to this work and be paid a salary of not less than $900 a year and that doctors be required to devote only part of their time but not less than two hours per day to the work and be paid a salary ranging from $600 to $900 per year.

The foregoing discussion merely outlines the subject of

[1] See discussion of the question by Gulick and Ayres in their book cited under references.

[2] *Am. Jour. Pub. Health*, 1913, vol. III, no. 4, p. 391.

medical inspection of schools. For detailed information the reader is referred to the references below.

The hygiene and sanitation of school buildings is an important subject of supervision, the responsibility for which rests partly with health authorities, partly with educational authorities. Sanitary control should be exercised over school water supplies and privies (in rural districts), cleanliness and ventilation, while common drinking cups and the like should be barred (see Chapters I, IV, V, and VI).

School instruction in hygiene is a function of the educational authorities. It would be well, however, for the latter in many cases to consult the health officer as to the effectiveness of the text-book used. Such books, in the higher grades, may include not only sound instruction in personal hygiene but also a simple, non-technical sketch of municipal sanitation.

OPEN-AIR SCHOOLS. — There are two classes of school-children whose health requires special attention: (1) those affected with latent tuberculosis; and (2) those who are simply anæmic, underdeveloped, run-down, etc. Open-air schools and special regimes should be provided for these two classes, separate and distinct from each other, although the treatment in the two cases does not differ materially. The maintenance of such schools, or classes, may be said to constitute a branch of school hygiene which cannot be treated in detail here.[1]

[1] See Gulick, "Tuberculosis and the Public Schools" (reprint of Dept. of Child Helping, Sage Foundation, 130 East 22nd St., N. Y. City); Cabot, "Tuberculosis Among School Children," *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. III, pt. I; Warren, "Open-air Schools for the Prevention and Cure of Tuberculosis Among Children," Pub. Health Bull., no. 58, U. S Pub. Health Service, 1912.

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INFANT HYGIENE

INFANT MORTALITY: THE PROBLEM

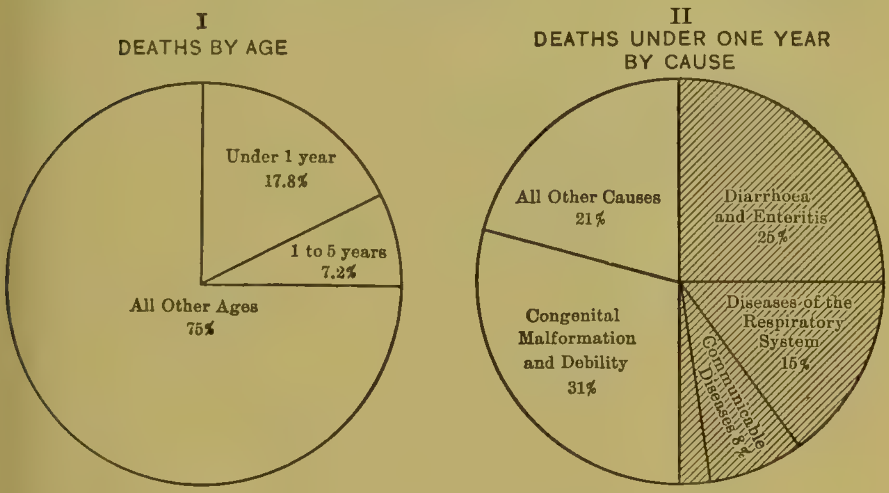
Infant mortality is one of the great public health problems of today. Until recently it was imperfectly understood, attacked only piecemeal, organized efforts being largely those of private philanthropy; but such an attitude on the part of health authorities can no longer be justified. It must now be attacked by the health authorities in close coöperation with the other social agencies involved. Sir Arthur Newsholme, the great English statistician, has said:

> Infant mortality is the most sensitive index we possess of social welfare. If babies were well born and well cared for, their mortality would be negligible. The infant death rate measures the intelligence, health and right living of fathers and mothers, the standards of morals and sanitation of communities and governments, the efficiency of physicians, nurses, health officers, and educators.

While there is here much that cannot be dealt with by health authorities alone, it is evident that they have important duties to perform, and that the main aspects of the infant hygiene problem must now be regarded as subjects, not of philanthropy, but of public health administration.

The basic statistics of infant mortality are set forth in Tables IV and V and Chart 4. The large percentage of deaths under one year of age is evident and suggests the

CHART 4. THE PROBLEM OF INFANT MORTALITY.
U. S. Registration Area, 1911. (Based on Tables IV and V.)
Shaded Portion represents fifty per cent (or more) *preventable.*



inquiry into the causes of death which is made in Table V and the second diagram in the chart.

TABLE IV

MORTALITY BY AGE

Registration Area of the United States. (From U. S. Mortality Statistics for 1911, Bureau of the Census.) Stillbirths not included.

Age group	Number of deaths	Per cent of total
All ages	839,284	100.0
Under 1 year	149,322	17.8
1 to 5 years	60,160	7.2
Total under 5 years	209,482	25.0

Specific Causes. — The causes may be commented upon in a general way as follows:

TABLE V

CAUSES OF INFANT MORTALITY

(Deaths under one year.)

Registration Area of the United States. (From U. S. Mortality Statistics for 1911, Bureau of the Census.) Stillbirths not included.

Nos. (International classification)	Causes and numbers of deaths			Per cent of all causes
....	*All causes*		149,322	100.0
104	*Diarrhœa and enteritis*		37,579	25.2
86–98	*Diseases of the respiratory system:*			
	89. Acute bronchitis	3,589		
	91. Bronchopneumonia	10,652		
	92. Pneumonia (lobar 2465, undefined 4846)	7,311		
	Other diseases of respiratory system	1,077		
	Total		22,629	15.2
6–10, 28–35, 37	*Chief communicable diseases:*			
	6. Measles	1,319		
	7. Scarlet fever	243		
	8. Whooping cough	3,687		
	9. Diphtheria (and croup)	887		
	10. Influenza	660		
	28. Tuberculosis of lungs	865		
	30. Tuberculous meningitis	1,166		
	31. Abdominal tuberculosis	225		
	Other forms of tuberculosis	344		
	(28–35 Total tuberculosis 2600)			
	37. Syphilis	1,787		
	Total		11,183	7.5
150,151	*Congenital malformation and debility:*			
	150. Congenital malformation (stillbirths not included)	7,879		
	151. Congenital debility, icterus and sclerema	38,434		
	Total		46,313	31.1
....	*All other causes*		31,618	21.0

Diarrhœa and Enteritis (25.2 *per cent*). — Due to improper methods of feeding, — especially to the substitution of artificial for breast feeding, — to bad milk supplies, and

also, to some extent, to improper clothing, irregular hours of sleep and other improper conditions leading to digestive disturbances. A great increase in this cause of death comes with the heated season, during which the alimentary system of infants becomes debilitated and milk supplies tend to suffer deterioration. Much gastrointestinal disease is bacterial in cause and the infection is favored by the warmth and flies[1] of summer time, as well as by filth and contact. As to artificial feeding, it is estimated that bottle-fed babies have only one-tenth the chance to live that breast-fed babies have.[2] Through the application of known hygienic principles practically all the deaths from diarrhœa and enteritis could be saved. It has been suggested that infantile diarrhœa be added to the list of reportable diseases, so that its distribution and causes may be studied and where necessary the cases be visited by the infant hygiene nurse.

Diseases of the Respiratory System (15.2 *per cent*). — This group of deaths is due to improper care on the part of mother or nurse as to ventilation, clothing and the like — all preventable. A number of these deaths is doubtless also due to the sequelæ of whooping cough, measles and other communicable diseases, the latter being omitted from mention in the death certificate.

Communicable Diseases (7.5 *per cent*). — It is not commonly realized how large a toll is exacted by the so-called minor preventable diseases of childhood — chiefly measles and whooping cough — which act mainly through their disastrous aftereffects. Protection from infection would obviate infection from these as well as from scarlet fever, diphtheria and influenza. Under this head is included

[1] A recent investigation made by Dr. Donald B. Armstrong for the New York Association for Improving the Condition of the Poor ("Flies and Diarrhœal Disease," Publication no. 79), while based upon imperfect experimental conditions, suggests an important relationship between the prevalence of flies and the occurrence of diarrhœal disease among infants.

[2] U. S. Children's Bureau, "Baby-saving Campaigns," 1913, p. 45.

also tuberculosis. About one-quarter to one-half of all cases of tuberculosis in children under five years of age is associated with the bovine type, and it is probable that all these cases derive their infection through the tubercle bacilli in cow's milk (Rosenau). Much of the tuberculosis in infants is therefore preventable through the safeguarding of milk supplies and the remainder through prevention of direct infection from tuberculosis mothers and other members of the family. The prevention of the syphilis which contributes also to this head is a more difficult problem, depending as it does upon the whole control of venereal disease. On the whole we may say that the group of communicable diseases is almost entirely preventable.

Congenital Malformation and Debility (31.1 *per cent*). — Many of the deaths in this group are due to inherited conditions not susceptible of control through public hygiene. Many of them, however, might be saved through prenatal precautions on the part of the mother, while others would live if proper care were taken of the infant after birth. Others are due to venereal disease of parents. It may be reasonably considered that a certain proportion of this group is preventable through hygienic measures, prenatal and postnatal.

The group of *all other causes* (21.0 *per cent*) is not susceptible of much analysis, although here also there are doubtless a small number of preventable deaths.

Summing up, it may be stated that of these deaths under one year (of which the Census Bureau estimates that the loss in 1912 was about 300,000) "*at least half* would now be living had we, as individuals and communities, applied those measures of hygiene and sanitation which are known and available." Such is the statement of the Chief of the National Children's Bureau (italics by the present author), who continues:

> Here is a vast and unmeasured loss of infant life due solely to individual and civic neglect. The economic and industrial significance of such

a loss in the general scheme of social well-being is beginning to be realized. It was once thought that a high infant death rate indicated a greater degree of vigor in the survivors. It is now agreed that the conditions which destroy so many of the youngest lives of the community must also result in crippling and maiming many others and must react unfavorably upon the health of the entire community.[1]

Infant Mortality Rates. — The "infant mortality rate," in the proper use of the term, is "the ratio of deaths under one year of age to births" (cf. page 516). The ratio is always calculated on this basis for the reason that the estimated population under one year of age is subject to inaccuracy. The calculation of an accurate infant mortality rate therefore depends upon a practically complete registration of births, a condition which as yet exists in few places in this country. Even among the Census Bureau figures only a small percentage of the returns are as yet at all satisfactory. These may be taken, however, to indicate that for 1910 the infant mortality rates for the most reliable cities of 100,000 population or over ranged from 82 to 231 per thousand births.[2] The former of these rates occurred in a comparatively new western city, while the latter occurred in one of the older eastern cities with some congestion and a factory-working population. Of course the ultimate goal to be aimed at is much below any of these rates, especially as where birth registration is deficient the calculated rate appears higher than it actually should be.

In the second year of life the death rate is considerably lower (see Chart 1, page 74). There is a decrease in diarrhœal and respiratory diseases and in congenital malformation and debility; the communicable diseases, however, keep up to the same numbers as the first year, indicating that while vital resistance is greater the sus-

[1] *1st Ann. Rpt.* of the Chief, Children's Bureau, to the Secretary of Labor, for year ending June 30, 1913, p. 7.

[2] Mortality Statistics for 1911.

ceptibility (and exposure) to infection remains the same (Registration Area statistics for 1910).

Causes of Death by Age. — A table giving the deaths of infants by cause, as follows, by days for the first week, by weeks for the first month, by months for the first year and by years for the first five years of life is very instructive. Such a table shows that among the very earliest deaths congenital defects and injuries at birth form a majority.

Of the deaths occurring in the early days of life, a large proportion are the result of conditions existing before birth. The latest reports of the Bureau of the Census on mortality statistics show that slightly more than 42 per cent of the infants dying under one year of age in the registration area in 1911 did not live to complete the first month of life, and that of this 42 per cent almost seven-tenths died as a result of prenatal conditions or of injury and accident at birth. Of those that lived less than one week about 83 per cent died of such causes, and of the number that lived less than one day 94 per cent died of these causes.[1]

These facts constitute the reason for *prenatal* work and for the control of midwifery and the raising of standards of obstetrics and obstetrical nursing.

After the first month this class of causes rapidly declines, and the causes due to external conditions in the care of the infant loom large. Hence the reason for *postnatal* work touching the care of the infant, milk supplies (where artificial feeding is resorted to and when the child is being weaned), etc.

Communicable disease keeps up a steady incidence at all ages, hence the child must be continually protected from the so-called "minor" (but in reality dangerous) diseases measles, whooping cough and influenza, as well as from scarlet fever and diphtheria.

Underlying Conditions and Problems. — We have now passed in review in some detail the specific causes of infant mortality and may now consider the general conditions which favor it. The chief of these are *ignorance and pov-*

[1] 1*st Ann. Rpt.*, Chief of Children's Bureau, 1913, p. 11.

erty. Then comes milk supply, once thought to play the very first part in the situation but now recognized to be secondary, though still important. Finally, there are the effects of bad midwifery and obstetrics, bad housing, dirt and congestion, flies, factory-working of mothers recent or prospective, occasionally neglect, and other related conditions. All of these conditions, with the exception of poverty, may be attacked by the public health authorities, while even the effects of poverty may be combatted through the assistance of charitable and social agencies.

A brief consideration of the history of efforts against infant mortality is instructive. It was once thought that by removing ailing babies from tenements and placing them in asylums and hospitals they would be saved, until it was found by experience that the institutions had high death rates and did not accomplish at all the benefits expected from them and that the child should be kept whenever possible with the mother. The reliance upon improved milk supplies entirely to save the situation was also disappointed. While the pure milk movement has had a strong effect in the promotion of infant and child hygiene, its limitations have now been recognized. The best grades of milk, such as certified milk, are out of reach of the pocket books of many, and the facilitation of the distribution of superior milk, where arranged, has frequently (though not invariably) tended to discourage the greatest salvation of the infant — maternal nursing.

THE REDUCTION OF INFANT MORTALITY

The following means of reduction should be undertaken by municipal health authorities, except in so far as such activities are carried on by private organizations.

1. **A General Survey** of the situation should be made. This will involve a study of the statistics of infant mortality and a consideration of the available means for meeting the situation disclosed. All deaths of infants under

two years of age should be tabulated and studied for two or more years back. They should be plotted on a spot map so as to bring out their topographical distribution and thus indicate the particular districts in which work is most needed. They should also be studied by age and by causes, by color and nationality of parents, etc., so that the health officer may have a thorough familiarity with the problem to be attacked. Later on, after work is organized, intensive studies of selected districts, pertaining to morbidity as well as mortality, should be made, so that further knowledge of underlying causes may be gained. As already emphasized, accurate infant mortality figures require as a basis not only good death records but also

2. **Complete and Accurate Registration of Births.** — This is a first and indispensable requirement which will be discussed in Chapter IX. It is, moreover, the starting point of instructive nursing and other preventive measures.

3. **Home Instruction.** — The chief cause of infant mortality being unhygienic care of the infant on the part of mother or nurse, grounded in ignorance frequently rendered hidebound by prejudice, the strongest step that can be taken is the instruction of mothers. One chief way of accomplishing this is through home instruction by an *infant hygiene nurse.* Such instruction is either *prenatal* — before the birth of the child — or *postnatal.* We shall refer again below to prenatal work, dwelling here especially on the postnatal instruction in the hygiene of the infant.

Here again a prompt and full notification of births is of prime importance. Without such notification valuable time is lost and the cases needing attention cannot be located. From the birth records the nurse makes a selection of cases to be visited. Many of the cases are in hospitals or under the close care of physicians, nurses or intelligent families, and may be omitted, while, on the other hand, it may be wise, if the work is limited (as is frequently the case, at least at the outset), to select only the

midwife cases or the cases in certain districts where the spot map of mortality shows the greatest need. The medical fraternity should understand that cases may be referred by any physician with any instructions which he may wish to have explained to the mother.

The following are the chief points to which attention is paid by the nurse:

FEEDING. — Advice is given on the details of feeding and physician's instructions, if any, are followed out. *Breast-feeding* is urged. All authorities agree that this is the greatest consideration in infant hygiene. The effect of artificial feeding is greatly to increase the incidence of diarrhœa, enteritis and malnutrition, and to render more susceptible to other affections.

> The importance of maternal nursing cannot be overestimated. Were mothers able universally to nurse their children, one-third to one-half of infant deaths would be expunged from our mortality returns.[1]

Davis, after a statistical study of infant deaths in Boston, arrives at this conclusion:

> Breast-feeding of all babies would have saved nearly a thousand lives last year [1911, in Boston], and the death rate per 1000 births would have been 71 instead of 127.[2]

There are various reasons for the failure of mothers to nurse their infants: among them alcoholism, debility, industrial employment, disinclination and false ideas. These must be opposed by persuasion and education; by aiding the mother to obtain an adequate supply of breast milk through proper diet and by addition to her diet milk and other foods having this effect; by remedying so far as possible the factory working of mothers soon after confinement. As for the physiological inability to nurse, it occurs

[1] Schereschewsky, in Bull. 56 of the Hyg. Lab., Pub. Health Service.

[2] "Prevention of Infant Mortality by Breast-Feeding," *Am. Jour. Pub. Health*, 1912, vol. II, no. 2, p. 67; also "Statistical Comparison of the Mortality of Breast-fed and Bottle-fed Infants," *Trans. XV Internat. Congress Hyg. and Dem.*, vol. VI, p. 188.

very seldom. Figures given by Dr. Herman Schwarz, director of the Pediatric Department of Dr. Hill's Maternity Clinic, New York, show that of 1500 mothers he found only four who could not nurse, when encouraged by proper care and advice at and after the confinement. Of these 1500 mothers 96.9 per cent nursed 1 month, 89.1 per cent 3 months and 77 per cent 6 months.[1]

The proper time for weaning must be governed; in some cases the tendency is to wean too soon, in others too late.

When, in the opinion of the medical adviser, the feeding is to be mixed (as in natural and gradual weaning) or the baby is to be put entirely on the bottle, then attention should, so far as deemed advisable, be paid to: (1) choice of milk supply, (2) home modification, (3) home pasteurization and (4) home care of milk.

(1) *The milk supply* must be obtained from a milk station or other special source or from a market source approved by the health authorities.

(2) *Home modification.* It appears to be the consensus of opinion of those who have given attention to the matter that home modification of milk according to simple formulas can be successfully taught to nearly all mothers. The New York Milk Committee, as the result of its studies, concluded "that home modification, even among the very poor and ignorant, is possible," and "that the results, as shown by the mortality and by the condition of the surviving babies at the end of the period of demonstration, prove that as good results can be obtained as when already modified milk is distributed."[2] The following is the experience of Newark, N. J.:

All milk was modified at the home by the mothers themselves. There is no difficulty where the method is simple, the instructions definite, a clean milk to hand and the cases followed by doctor and nurse

[1] Figures quoted by Public Welfare Committee of Essex County, N. J., which obtained similar results (Rpt. already cited).

[2] *Op. cit.*, p. 83.

that speak the language of the mother. With the exception of a very few cases we required nothing but raw diluted whole milk, cane sugar, barley water and salt. This I would emphasize as the most impressive and important phase of our work, because in this way alone . . . can rational, intelligent milk modification come into general household and general professional knowledge, can mothers and doctors learn the cost of clean milk, its value and where to obtain it. The mothers obtain a working knowledge of an infant's capacity and digestion, and when they act without advice they will at least have some experience to guide them. In this work of home modification the emphasis is laid on clean milk, clean bottles and nipples, proper intervals, the avoidance of additional food, and not on the modification. Doctors and mothers must be weaned from the superstition that milk modification is so complex a procedure, even when most scientific, that only a baby specialist can understand it and only a trained nurse prepare it.[1]

In Cleveland about ninety per cent of the milk distributed "is sent out in the form of pints and quarts and only ten per cent in the so-called modified form."

The reason for this is to teach as many mothers as possible how to prepare the food for their own baby, and, therefore, only when the child is too ill or the mother, for some reason or other, is unable to properly prepare her baby's food, does the Central Milk Laboratory modify the milk and put it up in individual feeding bottles. This system has been followed out since the birth of [this] institution in 1906.[2]

Moreover, the cost of modification at milk stations must be considered. The New York Milk Committee found that to modify and deliver cost 28 cents a quart.

(3) *Home pasteurization.* Except when the milk supply is of the highest character it should be pasteurized, and nearly all authorities advise that it be pasteurized in any case in order to guard against infection. The arguments for pasteurization will be reviewed in Chapter III. When the pasteurization is not performed before delivery of the milk it may be performed at home, even without special

[1] Levy, in Rpt. of Pub. Welfare Com. of Essex County, N. J., already cited, p. 10.

[2] Rpt. of Babies' Dispensary and Hospital already cited, p. 22.

apparatus.[1] It should be noted, however, that some authorities (e.g., Strauss and E. B. Jordan) are sceptical as to

[1] At the Philadelphia Milk Show of 1912 the following home method of pasteurizing feeding mixtures was given. Of course the proper time to pasteurize is after making up the mixtures.

Articles Needed

" One kettle large enough to hold eight bottles standing upright.
" One kettle about twice the size of the first, with a cover.

Method

" Place bottles containing the milk mixture in the small kettle. Nearly fill with cold water. Place this in the large covered kettle, half full of boiling water and allow to simmer gently for eight minutes. Remove from the fire, let stand for one-half hour (keeping covered). Then take out bottles, cool rapidly and place on ice."

The following method for pasteurizing milk in regulation bottles when it is not necessary to modify it and prepare feedings is given by the Chicago Dept. of Health.

" In a small tin pail place a saucer; on the saucer stand the bottle of milk (leaving the cap on the bottle). Now pour sufficient hot water (not so hot as to break the bottle) into the pail to fill same to within three or four inches of top of bottle and then stand the pail and its contents on the stove. The instant the water begins to boil remove the bottle of milk from the pail and cool it as rapidly as possible.

" Keep the bottle of milk in the ice-box and keep the cap on the bottle when not in use. When you remove the cap do so with a clean fork prong and be careful that the milk side of the cap does not come in contact with anything dirty."

The following method, in which the temperature is controlled by means of a thermometer, is given by L. A. Rogers of the U. S. Bureau of Animal Industry (quoted by Magruder):

" Milk is most conveniently pasteurized in the bottles in which it is delivered. To do this use a small pail with a perforated false bottom. An inverted pie-tin with a few holes punched in it will answer the purpose. This will raise the bottles from the bottom of the pail, thus allowing a free circulation of water and preventing bumping of the bottles. Punch a hole through the cap of one of the bottles and insert a thermometer. The ordinary floating type of thermometer is likely to be inaccurate, and if possible a good thermometer with the scale etched on the glass should be used. Set the bottles of milk in the pail and fill the pail with water nearly to the level of the milk. Put the pail on the stove

the practicability of the process in many cases, and that pasteurization by the dealer, under adequate supervision, is to be preferred.

(4) *The care of milk in the home*, though obviously important, is frequently neglected. Carelessness and ignorance in this regard may largely nullify the benefits of the best milk inspection. Circulars on the subject have been issued by a number of health departments. A detailed one is published by the New York Association of Sanitary Milk Dealers. The gist of them is to "keep the milk cold, keep it clean and keep it covered." In order to keep down the ice-bill and provide a simple and inexpensive means of refrigerating milk it is advisable to recommend, where nothing more pretentious can be had, a home-made ice box.[1]

or over a gas flame and heat it until the thermometer in the milk shows not less than 150 nor more than 155° F. The bottles should then be removed from the water and allowed to stand from twenty to thirty minutes. The temperature will fall slowly, but may be held more uniformly by covering the bottles with a towel. The punctured cap should be replaced with a new one, or the bottle should be covered with an inverted cup.

"After the milk has been held as directed it should be cooled as quickly and as much as possible by setting in water. To avoid danger of breaking the bottle by too sudden change of temperature, this water should be warm at first. Replace the warm water slowly with cold water. After cooling, milk should in all cases be held at the lowest available temperature.

"This method may be employed to retard the souring of milk or cream for ordinary uses. It should be remembered, however, that pasteurization does not destroy all bacteria in milk, and after pasteurization it should be kept cold and used as soon as possible. Cream does not rise as rapidly or separate as completely in pasteurized milk as in raw milk."

[1] "Many are unable to buy enough ice in summer to preserve milk in ordinary refrigerators for twenty-four hours. Most mothers, however, buy a five- or ten-cent cake every morning and by following the suggestion of Dr. Alfred F. Hess [N. Y. Dept. of Health] can make at home at small cost an excellent milk refrigerator that requires only a very little ice. . . . His device has been recommended for use by the health

VENTILATION. — The potent influence of the heat and ventilation in apartments has been the subject of considerable recent study, as a result of which it is seen that bad conditions in these respects increase not only diseases of the respiratory organs but also, through disturbances of the delicate circulation and nervous system of the child, disorders of the gastrointestinal tract. We now know that the worst effects of bad ventilation and of the stagnant summer heat in tenements are due to heat and humidity and not to any fancied increase in carbon dioxide. The summer season is especially critical. Winslow[1] has studied the subject in some detail and, quoting Holt and Park and other authorities, has brought out especially the relation between summer heat and infant health. Aside from the effect of the heat on milk supplies, he brings evidence to show that "summer heat *per se* has an important effect on infant mortality," with a conclusion that "heat may be extensively fatal only when combined with an abnormal food supply, but temperature is one of the two important

authorities of New York, Chicago, Philadelphia and other cities. Where nurses have urged the mothers to construct this home-made refrigerator their attempts have met with success. . . .

"Obtain a box from the grocer; any wooden box a foot in depth will answer the purpose. Buy a tin pail with a cover, one deep enough to hold a quart bottle of milk, and a slightly larger pail without a cover. Place one inside the other, and stand them in the center of the box. Now pack sawdust or excelsior beneath and all about them to keep the heat from getting in; complete the refrigerator by nailing about fifty layers of newspaper to the under surface of the box cover.

"The refrigerator is now ready for use. In the morning as soon as the milk is received, it should be placed in the pail and five cents' worth of ice should be cracked and placed about the milk bottle. The cover should be replaced on the can and the lid on the wooden box. Every morning the melted ice should be poured off." — *The Survey*, June 25, 1910, p. 504.

[1] Winslow, "The Relation between Bad Ventilation and Infant Mortality," *Trans. Am. Assn. for Study and Prevention of Inf. Mort.*, 1911, p. 149.

coöperating causes and perhaps the more far-reaching of the two in its effects." Schereschewsky has later made a detailed study of the relation of heat to infant mortality, as a result of which he concludes that "the action of heat as a direct cause in the summer mortality of infants has been greatly underestimated. . . . In the future much more weight should be given to its influence," and dwells on the importance of *indoor* temperature, which may be excessive even when the outdoor temperature is not.[1] It is the duty of the infant hygiene nurse to prevent the effects of hot, humid and stagnant air by securing proper ventilation in homes at all seasons. The question is, of course, closely connected with overcrowding and poor housing.

Clothing. — This is a matter related to the one just discussed. The prevailing faults here are tight clothing which restricts the circulation and movements of infants and the overdressing of them in warm weather, when, frequently, very little clothing indeed is needed.

Nostrums, "Pacifiers," Etc. — Discouragement of the use of all remedies and drugs not prescribed by the physician as well as of the various mechanical "pacifiers," such as false nipples, etc., is important."

Communicable Disease. — Under this head is included protection of the child against possible modes of infection and against dust and dirt and flies which may be the vehicles of it; also the watching for possible infection of the eyes by gonococcus, etc. Early vaccination of infants also should be urged; babies may, if healthy, be vaccinated as early as the third or fourth month.

Many of the diarrhœas of infants are infectious; hence in such cases the excreta and soiled articles should be disinfected in order to protect other young children in the family. It has been suggested that infantile diarrhœa

[1] Schereschewsky, "Heat and Infant Mortality," *Trans. Am. Assn. for Study and Prevention of Inf. Mort.*, 1913, p. 99.

be made, for purposes of study and control, a notifiable disease.

The nurse also supervises the hygiene of sleeping, bathing, etc., and endeavors to see that the baby is taken to the consultation once a week to be weighed and examined.

General Functions of Nurse. — The frequency of visits cannot be governed by arbitrary rules but should be according to the needs of the individual case. As the child grows older visits may be made less and less frequently and after the age of a year they may perhaps in the great majority of cases, if well, be dropped entirely in favor of the newly-born which are constantly added to the visiting list.

Where charitable aid is necessary the nurse will refer the case to the proper organization. She can be on the lookout for unreported cases of ophthalmia and keep a general observation on the work of midwives. She may discover unreported births. She should also act in a general way as inspector and report unsanitary conditions to the department of health. Even when maintained by an unofficial organization she should be appointed a special inspector by the board of health.

In qualification the nurse should be a graduate of a good hospital training school, preferably with some special experience in baby work and some knowledge of the methods of social work. At the present time there is growing a class of nurses trained especially for public health work. In work among foreign races some knowledge of the languages and dialects encountered is desirable, though not absolutely essential; interpreters, e.g., intelligent older children or "little mothers," may be found, and it is wiser to obtain superior ability and personality on the part of the nurse than this special advantage.

In her relation to the family the nurse acts as general adviser in all matters hygienic and arranges the details in regard to milk stations, diet kitchens and other external

agencies. In her relation to the medical profession she preserves an attitude of impartiality and deference. Where there is a family physician she acts only with his consent and aids in the accomplishment of his instructions. Where there is no physician the family may make its own choice of one or take the infant to a clinic. Where, of course, the case is beyond ordinary care on the part of mother and nurse and medical attention is desirable, she urges that it be obtained.

When there is a consultation or milk station, the nurse assists at it, following her cases there as well as at home. When the work is under private auspices small fees may be taken in some cases, but where it is under public control there are none. Nurses should work under the health officer or under proper medical control, and undertake no duties and assume no responsibilities which should properly be restricted to the physician, such as the prescribing of medicines, special diets and the like.

When babies under her care are sick, the nurse should give them as much nursing attention as is consistent with her duties towards other cases; this is not only a direct benefit to the case, but it also wins attachment and confidence among the people. When, however, the nursing care demanded is more than she can manage with due respect to her other cases, then the services of a district nurse may be called into requisition.

Finally, the nurse should teach mothers to be capable and self-reliant, so that they will not need to depend upon the nurse at every turn. A nurse may be an excellent helper herself and yet leave the mother as helpless and incompetent as before she was called in. On the contrary, the mother should be taught so that she may not only help herself in future, but so that she may also be helpful to her friends and neighbors.[1]

[1] For further details on organization see " New Zealand Society for the Health of Women and Children: An Example of Methods of Baby-

4. **Consultation and Milk Stations** ("*Infant Welfare Stations*"). — Infants' consultation classes are an outgrowth of the milk station system for the distribution of superior grades of milk. When this milk was modified it was found necessary to have babies brought to the station for examination so that the formula might be adapted to the individual child; hence the consultation class. It is now, however, generally agreed that the prime function of milk stations is to keep babies under *expert supervision* and the mothers under medical instruction. Whatever a station may stand for in theory, the weekly weighing and examination of babies and free advice to mothers take the chief position, while the supplying of milk is simply an adjunct and an attraction. While the character of milk supplies is unquestionably important, the relative weight accorded to milk stations as such has been lessened by three things: the placing of the emphasis on maternal nursing rather than upon the facility of obtaining milk for artificial feeding, the teaching of the home modification of milk, and the improvement of market milk supplies for infant use which has been taken up in many places. In any event it is a mistake to lead the public to suppose that such stations are chiefly for the dispensing of milk to the exclusion of factors of more general importance. The warning note against placing too much dependence upon the simple pure-milk station is sounded in the following:[1]

The evolution of the infants' milk station is essential. Pure milk, however desirable, will never alone solve the infant-mortality problem.

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saving Work in Small Towns and Rural Districts," Bureau Publication, no. 6, U. S. Children's Bureau, 1914; and for a précis of details of infant hygiene "The Care of the Baby," Supplement no. 10 to the Public Health Rpts., U. S. Public Health Service, 1914, and "Infant Care," free pamphlet of U. S. Children's Bureau.

[1] Dr. Josephine Baker, director of child hygiene of the department of health of New York City, *Trans. XV Internat. Congress on Hyg. and Demography*, 1912, vol. III, p. 149.

Under our system of home visiting to instruct mothers in the care of babies we have demonstrated that babies may be kept under continuous supervision at the cost of 60 cents per month per baby, and the death rate among babies so cared for by us has been 1.4 per cent. The death rate among babies under the care of the milk stations has been 2.5 per cent, and the cost $2 per month per baby. Without overlooking the value of pure milk, I believe this problem must primarily be solved by educational measures. In other words, the solution of the problem of infant mortality is 20 per cent pure milk and 80 per cent training of the mothers. The infants' milk stations will serve their wider usefulness when they become educational centers for prenatal instruction and the encouragement of breast feeding and teaching better hygiene, with the mother instructed to buy the proper grade of milk[1] at a place most convenient to her home.

The following extracts on the *methods and organization of infant welfare stations* are taken from a valuable bulletin issued by the New York State Department of Health.[2]

Methods. — Although the stations are usually called "infants' milk stations," the dispensing of milk is now universally recognized as but a minor part of the work of the station. In fact, a better and more descriptive name for the stations would be "infant welfare stations." It is true that the sale of milk attracts the mothers, and at Yonkers certified milk is sold two cents below the market price with the intention of drawing mothers to the station. But with the progress of rigid city milk inspection, such as is now organized in several cities, the importance of dispensing pure milk decreases and the educational features of the work expand. In many of the cities considered, the milk sold at the stations was not certified but the best obtainable from regular market sources, an endorsement of the good quality of the milk sold in those cities.

A brief summary of the work in the twelve communities is given at the end of this report. A medical director is usually appointed to have charge of the entire work of the welfare station. Two or more physicians coöperate with him and are assigned days at the babies' clinics. Usually a physician is asked to serve on consecutive clinic days, the season

[1] In New York City market milk is graded and marked so that grades fit for infants can be distinguished. — The Author.

[2] Monthly Bulletin, N. Y. State Dept. of Health, Dec., 1913. See also Special Bull. of Same Dept. on Conference on Infant Welfare held June, 1913, containing important papers on various aspects of the subjects.

being divided up between the medical director's assistants. For instance, in Cohoes four doctors served twenty-two days each during the three months the station was in operation. This method has the advantage of securing more uniformity of treatment than where the doctors serve alternate weeks. To secure the best results with volunteer physicians a uniform course of treatment and care should be agreed on and any deviation from it be made only in consultation with the medical director.

The work of the nurses is divided into examining the babies at the station, dispensing milk and visiting the babies in their homes. Home visits are of the greatest importance. In Poughkeepsie as many babies are visited in their homes as are enrolled at the station. In Yonkers the nurses are supplied every week with lists of all births in their districts, and the babies are visited immediately. This is a plan which should be recommended to all stations as worthy of adoption. Of course, discretion is used in utilizing these lists, as it is obvious that some of the babies in certain streets will be well cared for and need not be visited.

The coöperation of the physician in a community where a milk station is established is most important. It is surprising that there has been opposition to the work by physicians in some cities, but this opposition is being overcome. Cards are given to all physicians in Utica for use in referring their patients to the stations. Also in many cities the services of the nurses are offered for any case which private practitioners may have, where the mother is too poor to pay for such services.

The problem of location of a station has been met in some cities as Rochester, Utica, Little Falls and Syracuse by utilizing the public schools during the vacation period. In Buffalo rooms are used in settlement houses. The rooms should be large and light, with a smaller room in the rear where private consultations may be held. A large room offers a fine opportunity for talks to mothers on other days than clinic days, as is done at Poughkeepsie and some other cities.

To date, little emphasis is placed on work among expectant mothers in the stations considered. Usually, however, when the nurse hears of an expectant mother, she visits her and invites her to the station to attend the classes for mothers with babies. At Buffalo the nurses follow up all cases heard of, as is done in several other cities. In Utica prenatal work was begun in September and is now a part of the regular station routine.

There is no doubt but that this work will shortly be incorporated in every station's activities, although the growth of the stations' clientele to the present time has been so great that additional activities could not very well be undertaken.

Records. — In a review of the work of the infant welfare stations in the State the matter of records of the work is of great interest. In most instances the family histories of the baby and weekly histories of its condition are kept with more or less uniformity. Printed forms for daily or monthly summaries are used at Yonkers, Buffalo, Rochester and Schenectady. While daily reports are hardly needed when there is only one station, a weekly or monthly compilation of the condition of the babies and work of the station is extremely necessary. A complete weekly or monthly record of the attendance and condition of the babies at a station, together with a report of the activities of the nurse, such as visiting, etc., is needed for guidance of the medical director and for public proof of the value of the work. The principal record and report forms used at the stations are reproduced.[1] They furnish an interesting study of the records employed in the different cities.

Relief Work. — Infant welfare stations, although at present largely supported by private funds, are in no sense a charity. Through the example of the New York and Rochester municipalities, the work has been placed on the same basis as that of the public school. In some communities it is extremely necessary to exclude any idea of charity, or mothers will not attend the station. It is not only the very poor who make up the clientele of the stations, but many mothers attend who are referred there by their family physicians, and who are anxious to have the nurse teach them the proper care of their babies.

Sometimes, however, relief is urgently needed, for instance, by a very poor family when the husband is out of work. So arrangements are usually made by the station management for the temporary payment for the milk in such cases.

In five of the cities the stations have funds for payment for milk when the mother is unable to do so. Four other cities refer relief cases to private or city charities. One station reported no relief given at all. In all cases little relief was given as the price of the milk is generally the same or lower than the market price of ordinary milk, and few mothers are not able to pay. It is evident from the survey of the stations included in this report that free milk or partly free milk for mothers is an extremely small item in the management of a station. At Utica it was found that mothers would not come to a place where "charity milk" was given. To overcome this a small donation was given by the milk station committee to the local charity organization society to whom all cases for relief were referred. This donation amply covered the free or partly free milk given by the station this summer.

[1] On account of lack of space the records and forms unfortunately cannot be reproduced here.

Literature for Distribution. — Almost all the stations have printed leaflets or cards with brief advice to mothers on the care of the baby. Some of these have been printed in five languages as at the Rochester stations. As the majority of the mothers who attend the stations are foreigners, simple leaflets in other languages than English are of value. The Department's booklet on " How to Save the Baby " is distributed in many of the cities.

SUGGESTIONS FOR THE ORGANIZATION OF INFANT WELFARE STATIONS

Infant welfare or milk stations are now considered as educational centers for mothers, rather than simply places where pure milk for babies may be bought. As early as 1897 two infant milk stations were opened in Rochester, these being the first outside of New York City. Previous to that the work had been started in New York City as far back as 1873 by the New York Diet Kitchen Association, which furnished nourishing food and pure milk to the poor.

The work of an infant welfare station consists of dispensing pure milk to mothers for themselves or their babies, and teaching the mothers how to take proper care of their babies. In many stations prenatal work is also undertaken.

Organization. — In some cities the stations are supported by municipal funds, but where this is not possible a committee is formed who raise the necessary money and manage the work. A medical director is appointed who has direct charge of the work. The staff consists of at least one nurse for each station and several volunteer physicians who have charge of the weekly clinics.

Financing. — The first work after the organization of the committee is the raising of funds. From reports of the work in the State this has not been a very difficult matter. One city actually has had subscribed twice as much money as it could use last summer. In Utica milk bottles with slit tops were placed in various public places, such as drug stores, libraries, etc., and by this novel and appropriate method a large sum was collected. Other means of raising funds readily suggest themselves so that this part of the work will not be considered at length.

Location. — The station should be opened as near to the center of the district it is to serve as possible. A study of the location of infant deaths in a city will show better than any other method where a station had best be placed. Rent can be saved if the coöperation of a settlement house can be secured and the station installed there, as at Albany. In Syracuse, Rochester, Little Falls and several other cities rooms in the public schools were utilized during the summer vacation for this purpose. Where such plans are not practicable for the housing of the

station, the renting of a store is necessary. In several cities, notably Yonkers and Schenectady, this has been done with great success, as a store can usually be rented in the heart of any district to be served.

Size of Station. — Two rooms at least are necessary for the station. One should be a large milk-dispensing room and suitable for the holding of classes for mothers. Camp chairs are excellent for use here, as, when the class is over they may be folded up and put aside, allowing free use of the floor space. A smaller room at the rear of the dispensing room will serve for a consultation and weighing room. Here the doctor in charge and the nurse examine and weigh the babies at the weekly clinic. This room should be supplied with running water and arrangements for heating water, etc. The consultation room may also be utilized as a demonstration room for demonstrating modification of milk to mothers.

Equipment. — For the dispensing room the principal equipment required is an ice box where the milk bottles can be placed in direct contact with the ice, [which] is preferable to one where the ice is kept in a separate compartment. A table for the nurse is needed, also sufficient chairs for nurse and mothers. If classes are held, a number of folding camp chairs will be necessary. The consultation room contains the doctor's desk or table, table for weighing scales and a cabinet for the various supplies. Also utensils for bathing the baby. [Also sink and gas stove.]

Dispensing of Milk. — Milk is bought by the station management and sold to the mothers. In stations where certified milk is used the market price is usually prohibitive, so it is sold at cost or less. Milk not certified, but of a good grade, is dispensed in many stations, and in cities where there is an efficient system of milk inspection this milk attains a high standard. Where there are many stations the method employed by the New York City Health Department for the dispensing of the milk might be employed. There the milk is sold for the dealer in each station by matrons who are responsible to him for the daily receipts.

Management of Work at Station. — The nurse is in attendance at the station from about 8:00 a.m. to 12:00 noon for the purpose of dispensing milk. In large stations, as already stated, a matron is employed to dispense the milk so that the nurse will have more time to devote to her other duties. Mothers are given advice in these morning hours, and on clinic days the babies are weighed and new babies examined. In the afternoon the nurse visits the mothers in their homes, teaching them to modify the milk if necessary. This instruction to mothers is the most important part of the work of the nurse. Milk, no matter how pure, is harmful if given to the baby in a dirty bottle or modified in

dirty utensils. Patient and persistent work on the part of the nurse is necessary, and her duties include the giving of much advice on household management.

In Yonkers the nurses are furnished a list of births every week by the health department, and call on the mothers at once. This is an excellent plan as it insures the mother proper care for her baby from the first. In some cities the nurses make a point of visiting expectant mothers and hold classes for them at the stations. This is comparatively new work and is rapidly becoming a feature of welfare station activities. The doctor assigned to the station has at least one clinic a week, where babies are weighed and new babies examined. Sick babies are referred by him to the family physician or a hospital or dispensary, and mothers of sick babies are instructed in the proper care of them. Where the baby is too ill to be brought to the welfare station the doctor visits with the nurse and takes charge of the case if the family cannot afford to pay for the services of an outside physician. The matter of treating babies by the welfare station doctor is a rather delicate one, as some opposition will develop toward the work by misguided physicians who believe that free treatments and advice will hurt their practice. Mothers are always referred to their own physicians and encouraged to go to them. The services of the nurse are always free to all doctors of the community where they have sick babies which need such care.

Records. — In organizing a station two records are absolutely necessary. Others may be added as the work grows and the need is felt for them. The two are the registration card and the weekly or monthly report form compiled from information recorded on the registration card. The following forms[1] are recommended, having been prepared with a view to simplicity and efficiency. A well-managed station, even if small, should have complete records of its work, and the forms should be so designed as to give this information in the clearest and most available manner.

These forms have been prepared for use after a study of the needs and requirements of the welfare stations in cities of varying sizes in the State. Simplicity has been aimed at and only the most essential information is noted. Data of a purely sociological character, although valuable in determining the economic and social position of the families, has been omitted as not of immediate importance and likely to unduly complicate the records.

The vertical record registration card reproduced has been made as self-explanatory as possible. The vertical weight and feeding chart on the left gives at a glance the gain or loss in weight together with the kind and changes of feeding.

[1] See the Bulletin for these forms, which cannot be reproduced here.

Below the registration record is the prenatal record for use in expectant mother work. By including this on the same card the prenatal history is readily available and it may also be filled out for babies whose mothers have not been under observation during pregnancy, but who have brought their babies to the station.

A comprehensive report of the work at the station whether compiled weekly or monthly, should show:

(1) Number of babies at beginning of month.
(2) New babies; how referred to station.
(3) Babies dropped from roll, and cause.
(4) Babies on roll at end of month.
(5) Attendance of mothers at classes.
(6) Condition of babies and how fed.
(7) Report of visits of nurse.
(8) Quantity of milk sold.
(9) Relief given.
(10) Prenatal work.

With this in mind the accompanying weekly or monthly report blank is suggested. Local application of it will probably call for additions. When correctly filled out, the movement of the station clientele can be intelligently followed, and the improvement in the babies noted. The coöperation of physicians and philanthropic organizations is also recorded, and the reasons for babies ceasing to come is shown. This last is very important where there are many stations.

The reverse side of the card contains the names and addresses of babies who have died during the month. Also the names of babies transferred to hospitals with name of hospital.

Relief Work. — There are usually very few mothers who cannot afford to pay the small price asked for the milk. It is best to have those who need help in procuring milk for their babies pay as much as possible, even if it is only a few cents. A separate fund at the disposal of the welfare station for this purpose is worth while as relief may then be given promptly. Some stations refer all cases to the local charity organization society for investigation and relief.

Literature for Distribution. — The pamphlet on "How to Save the Baby," issued free by the State Department of Health is offered to all stations for distribution to mothers. In some stations small cards or folders containing brief advice are distributed. Where different nationalities are served by the station the literature should be printed in their respective languages.

Cost of Operation. — The monthly cost of operating the welfare stations depends on many conditions. The principal expenses are:

1. Salary of nurses and matrons.
2. Rent of station.

3. Equipment.
4. Supplies (bottles, ice, printing, etc.).
5. Loss on sale of milk (if sold less than cost).

In many cities the use of public schools during the summer solves the rent problem. In others rooms in settlement and church houses may be secured free of charge. The equipment of a new station is often donated or paid for by special subscription.

Some typical budgets are given below as an indication of the total cost of operating a station for the summer. In Utica, Little Falls and Syracuse public schools were utilized for quarters, and in Albany the station was given space, rent free, in the South End Dispensary. The cost per month ranges from $129 in Albany to $280 in Syracuse, the average being $195.50. The cost of equipment of all stations except the one in Albany is included in the totals.

The monthly cost per baby, which is shown below, is based on the registration of the stations for August 31. The actual cost is probably a little higher, as this is the month of largest enrollment. Invidious comparisons of these figures should not be made, as operating conditions vary greatly in different cities. The loss on the sale of milk, for instance, is a large item at some stations, especially in those where certified milk is dispensed.

As should be expected, a large enrollment decreases the cost per baby. The budgets show a gradual decrease of cost per baby with the increased enrollment. The number of babies which one nurse can care for is limited by the situation of the station — whether the station draws from a congested neighborhood or from a widespread area. The character of the people living near the station also affects the enrollment. In the poorer districts the registration is usually much larger than in those sections of the cities where the families are better off.

TYPICAL BUDGETS OF INFANT WELFARE STATIONS

	Utica	Little Falls	Albany	Syracuse	Average per station
Months open	July, Aug.	July, Aug.	June, July, Aug.	July, Aug.	....
Number of stations	1	1	1	2	....
Total disbursements	$463.00	$281.00	$487.00	$1,122.00	$470.00
Babies cared for (Aug. 31)	382	94	69	473	203
Total disbursements (per station per month)	$231.50	$140.50	$129.00	$280.50	$195.37
Cost per baby (per month)	0.61	1.49	1.87	1.11	1.04
Total quarts of milk dispensed	5,335	1,188	1,060	12,440	5,005½
Total quarts per baby (per month)	6.9	6.3	5.1	11	7.7

5. "Little Mothers." — This important phase of the infant welfare movement is well described in the following extract from the Bulletin of the Children's Bureau on "Baby-Saving Campaigns."

"Little Mother Leagues" and "Little Mother Classes" in the public schools represent efforts made in New York, N. Y., Kansas City, Mo., Cleveland, Ohio, and Milwaukee, Wis., to carry instruction into the home from another angle. "Little Mothers" are the school girls who have to help care for babies or for younger children at home. Of course the schools of every city have many such, and as they live in all parts of the town and come from every class, it follows that to reach them is to influence an ever-widening circle of mothers and homes where instruction is most needed. The policy in New York City was to organize these school girls who were caretakers of little children into groups and teach them the care of babies. These groups were called "leagues" and the whole organization was "The Little Mothers' League." Dr. Josephine Baker, of the New York division of child hygiene, in a paper before the International Congress of Hygiene and Demography, in September, 1912, says:

> The aid of over 20,000 girls from 12 to 14 years of age was enlisted and made of practical value by the formation of "Little Mothers' Leagues." These are still one of the most important branches of our work. The girls are taught all practical methods of baby hygiene and feeding. The potential value of training young girls for intelligent motherhood is not only of immense importance, but the immediate results have been striking in the improved care that is given to the babies who are directly under the care of these young girls. As true prevention work, it ranks of first importance in the prevention of infant mortality in this and the next generation. In all 239 of these leagues were founded in 1911, and practically an equal number have been organized this year (1912). Weekly meetings are held for instruction. Each league is under the supervision of a doctor and a nurse from the division of child hygiene. Each weekly lesson takes up some particular phase of baby care. The doctor gives a short, simple talk; then, with the nurse, demonstrates his subject. Our outline embraces the importance of breast feeding, hygiene of the home, cleanliness, ventilation, etc., hygiene of the infant, including bathing, dressing and value of fresh air, infant feeding, with methods of milk modification. The lessons are simple and practical, and the children are required to carry out each part of the work. Babies are not lacking for demonstration purposes, for

> nearly every little mother brings her own charge to the meetings, and often the rivalry is great to have "my baby" chosen as an object lesson of health and right living. The members write and act little plays, the play always hinging upon some newly discovered way to keep the baby well. The real iniquity of lollypops and dill pickles as baby food is being uncovered, and these and kindred baby pacifiers of former days are being relegated to oblivion.

In Kansas City and in Milwaukee all girls desiring to enter these classes are enrolled, whether or not they are caretakers of babies at home. The health department undertakes to teach baby hygiene through the public schools to all girls who care to avail themselves of the opportunity by joining the classes — a step, in short, toward the movement in French and German schools in education for motherhood.

In Cleveland, Ohio, instruction is given to girls in the seventh and eighth grades by the introduction of an infant hygiene division in the domestic science department of the schools. On June 9, 1913, there were 48 classes a week, with 884 girls taking the work. The course consists of six lessons, as follows:

Lesson I. — How to keep baby well. Causes and prevention of high death rate.

Lesson II. — Growth and development of normal baby.

Lesson III. — Pattern demonstration. Each pupil cutting patterns for baby's outfit.

Lesson IV. — Feeding: Maternal nursing, artificial feeding, dangers of patent foods. (Charts for five lessons.)

Lesson V. — Bath: Things necessary, preparation, how much good it does baby.

Lesson VI. — Common illness among babies. First home treatment in beginning of intestinal disturbances.

6. Milk Supplies. — While, as stated above, the rôle of milk supplies in the infant mortality problem has been exaggerated in proportion to other factors, nevertheless their absolute importance should not be underestimated. Unclean, bacteria-laden milk is responsible for a great deal of sickness among infants, while bovine tuberculosis infection through non-tuberculin-tested and unpasteurized supplies constitutes another problem. "It is now estimated that perhaps 7 per cent of the tuberculosis in man

is of bovine origin." (Rosenau.) This is contracted through milk and, according to the opinion of many authorities, in early infancy. The Children's Bureau has this to say of milk supplies:

> The importance of milk control in summer months [and, it must be added, at all seasons] cannot be overestimated. Health officers are practically as one in the opinion that unclean milk, or the improper preparation and care of milk in the home, is responsible for a large share of the increase in infant death rate that comes with the heated season.[1]

Milk supplies will be taken up in detail in Chapter III. The necessity for proper home care of milk has already been considered.

7. **Housing and General Sanitation.** — Due attention must be paid to securing proper housing conditions, especially as to light, ventilation and cleanliness. Other environmental conditions should be looked after, breeding places of flies and vermin removed, etc. Recent research tends to show that flies play an important part in the production of infantile diarrhœa; not only should measures be directed toward suppression of breeding places, but, pending suppression, educational work drawing attention to possible danger from flies should be carried on among mothers by the infant hygiene nurse.

8. **Unofficial Infant Welfare Organizations.** — These play an important part. Baby day camps, day nurseries, etc., are commonly conducted by private philanthropy, but should be under the tactful surveillance of the health officer and should be coördinated with the other baby-saving agencies of the community. "Baby farms," or places where babies are boarded out, should be subjected to official inspection and some control, through licensing or otherwise, should be exerted over them. Other coöperating agencies are the diet kitchens and the like, from which mothers as well as babies may obtain nourishment in the shape of milk, eggs, etc.

[1] Bureau Publication no. 3, "Baby-Saving Campaigns," p. 15.

Coöperation should be maintained with the general hospitals, lying-in hospitals and other institutions, and the development of social service work in connection with them is to be encouraged.

We assume for the present that nurses and infant welfare stations are under the control of the health authorities, but as a matter of fact these are very frequently maintained by unofficial organizations (see later).

9. **Prenatal Care.** — The figures, already quoted under the head of infant mortality rates, which show that the majority of deaths of very young infants, as well as many stillbirths, are due to prenatal conditions or to injury or accident at birth are a compelling argument for the prenatal care of mothers and the improvement of the practice of midwifery and obstetrics. This indirect but highly important protection of the child through the care of the mother has been, of the main phases of infant welfare work, the last taken up. The problem is attacked by getting information of pregnant women at as early a time as possible and keeping them under observation and instruction by competent visiting nurses until the time of delivery. This work has now been taken up by a number of infant welfare organizations. For example:

The New York Milk Committee has carried on for two years an extensive campaign of prenatal instruction. We have had 2003 mothers in our care. They are visited regularly every ten days to two weeks from the time they are enrolled until the baby is a month old. It makes no difference whether the mother will be confined in the hospital, or by a physician or midwife in her home. . . . We have had 2070 babies. . . . Our rate of stillbirths among our supervised mothers has been 25 per cent lower than for the Borough of Manhattan during the same period. Of babies who were born alive, there have been 25 per cent less deaths during the first month than for the same period in the Borough as a whole. Of our mothers, 93 per cent of all those whose babies were living at the end of the first month were nursing them entirely. Only three and a fraction per cent were being fed artificially.[1]

[1] *Trans. 4th Ann. Meeting Am. Assn. for Study and Prevention of Infant Mortality*, 1913, p. 183.

Similar results are given for the work carried on in Boston under the Women's Municipal League, which states that

> The number of births in the city in 1912 was approximately 19,000, and the percentage of stillbirths in that year was 39.3 per thousand living births. Had our percentage of stillbirths [18.6 per thousand] obtained throughout the whole city 393 babies would have been born alive whose lives, as it was, were extinguished before they saw the light of day.[1]

While this class of work has hitherto been carried on entirely by unofficial organizations, it is closely related to the instructive work of the infant welfare nurse and might well be added to it.[2]

10. **Control of Midwives.** — The ignorant, ill-trained midwife can do a vast amount of damage, before birth, at the time of delivery, and in the aftercare of both mother and infant, as the statistics of infant mortality and deaths from puerperal causes will show.

We have noted above the large proportion of deaths of infants due to factors over which the obstetrical attendant has control. Of the practice of physicians as obstetricians we say nothing here except that it should be adequately controlled, like other medical practice, by proper state authority, for the incompetent male obstetrician is a factor to be considered. As to the practice of midwifery, it should be subjected to strict supervision by the state in the same manner as general medical practice; such supervision should require adequate training as a prerequisite for a license, and there should be courses for midwives in connection with hospitals and medical inspection

[1] *Trans. 4th Ann. Meeting Am. Assn. for Study and Prevention of Infant Mortality*, 1913, p. 188.

[2] See Schwarz, "Prenatal Care," *Trans.* just quoted, p. 174, and other discussions in the vols. of *Trans. of the Am. Assn. for Study and Prevention of Inf. Mort.* For an account of the details of prenatal care see the valuable pamphlet on "Prenatal Care," by Mrs. Max West, Bureau Publication no. 4, Children's Bureau, U. S. Dept. of Labor, 1913.

of the work of licensed midwives from time to time. The midwife is probably too deeply rooted in social and economic conditions to be eliminated entirely, as has been suggested, but may be made the best of through an official control which is feasible as well as necessary. The competent midwife is capable of handling a normal birth properly, while she should be required to call in a physician if abnormal symptoms present themselves. In many communities a large proportion of the births are attended by midwives who also give nursing care, etc., at a very low cost, and to attempt to deprive the poorer population of this midwife service, which it appears may be made as safe as the corresponding order of medical service, would be inadvisable. At present it is lamentable that "some states especially exempt midwives from all provisions of medical practice acts, and insist that they can practice without license and control," and that "not one single state in the Union has control over schools of midwifery in regard to the character of instruction and the requirements for admission." A simple and effective means of eliminating the incompetent midwife "consists in getting the same kind of state control over schools of midwifery and the admission of midwives to practice as is exercised over medical schools and the admission to medical practice."[1] Attempts at local control may have some effect but must necessarily be incomplete.

It has also been suggested that a special class of trained nurses might be licensed to act as midwives and gradually supplant the latter.

11. **Use of Printed Matter.** — Many health departments issue leaflets and the like for the instruction of mothers. Such matter is, however, of no use with the ignorant classes and in any case is of value only as supplementary to oral instruction and demonstration.

[1] Schwarz, paper quoted above. Cf. Van Blarcom, "Midwives in America," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 3, p. 197.

There are many factors in the infant welfare problem which cannot be extensively considered here. For example, there is the effect of the working of mothers in factories before and after child-birth. A speaker at the XV International Congress on Hygiene and Demography[1] presented figures showing that in factory towns in Staffordshire County, England, the babies of mothers at home showed an annual death rate per thousand births of 146, while the rate for babies of mothers in factories or away from home during the day was 201. The Medical Officer of Health of Birmingham, going into the question in a very poor working class population of his own district, concludes that "in the special area under review there appears to be no doubt about the prejudicial influence of employment of pregnant and nursing mothers in factories, both on their infants and on themselves"; but adds that "poverty has, however, a much more deleterious influence; and if by employment poverty can be removed or lessened, such employment is the lesser by far of two evils."[2] This is a matter which cannot be directly dealt with by health authorities, but relief can be given in some cases through charitable aid which enables the mother temporarily to discontinue factory employment, wholly or in part. One of the evil effects of such employment is that the infant is frequently placed on the bottle and left at home in charge of some incompetent person.

ORGANIZATION OF INFANT HYGIENE WORK

Most infant welfare work, aside from the supervision of milk supplies, has thus far been maintained by unofficial organizations. There is no doubt, however, that the time is ripe, and the need urgent, that health departments in all communities, small and large, come to the fore and assume their proper responsibilities in this most important

[1] Reid, vol. III, pt. II, of the *Transactions* of the Congress, p. 943.
[2] Robertson, *ibid.*, p. 952.

public health field; that they initiate work where there is now none; and coördinate and complete the scheme of work where philanthropic organizations are already at work. The health authorities alone have the power to compel registration of births, to send out nurses as official inspectors, to supervise milk supplies and to expend public funds in the establishment of infant welfare stations. Hence leadership and efficiency both depend upon the department of health.

The plan of organization and operation may be somewhat as follows (adapted to local conditions):

1. Make a brief statistical *survey* of the infant mortality situation and obtain the *funds*, public or private, necessary.

2. Studying the situation more in detail and determining in what districts the greatest mortalities occur, divide the community into *districts* according to the amount of infant mortality, taking into account also the character of the population and convenience of nurse in getting about district. Of course small communities need no districting.

3. In each district, at as convenient a point as possible, arrange for an *infant welfare station* to serve as an office for the nurse of the district, for consultation classes and, if milk is to be dispensed, as a milk station.

4. To each district assign one infant welfare *nurse*, to have visiting charge of the infants in the district, to assist at consultations, making her headquarters at the station. The number of babies under the care of one nurse should not be greater than 150.[1] This nurse is to have charge of babies whether sick or well, unless they are so ill as to require hospital care or to be placed under the care of a

[1] The New York Milk Committee (Special Rpt. on Infant Mortality and Milk Stations, 1912, p. 130) states that "one nurse for every 100 babies is the limit for the maximum of efficiency, and probably 300 babies the limit for any one station." These estimates would of course vary with local conditions, e.g., density of population, location of station, etc. In a less densely settled district the latter figure would be reduced, the former to a less extent in proportion.

special district nurse. Thus the nurse follows the cases both at home and at the station. If resources warrant, prenatal instruction work may be carried on by nurses.

5. Obtain the regular services of a *physician* for each district, who will conduct at the station the weekly consultation. Physicians will frequently volunteer their services for this purpose. If the same physician is willing to serve in more than one district, so much is gained in uniformity of methods, an advantage on account of the moving of families from one district to another. When babies become ill they may be referred to family physician or to a clinic if one is available apart from the consultation station. Of course due tact must be exercised in relation to private physicians.

6. Where various divisions of the work (as is usually the case) are carried on by unofficial organizations there should be a central directing committee, to determine questions of principle rather than details, composed of delegates from the various organizations involved. The health officer may act as executive officer of this committee, preparing propositions for its consideration and working out the relations between various parts of the work, thus practically guiding its policies without necessarily having direct control.

7. Modifications of this plan according to local conditions will suggest themselves. In small cities where there are several districts it may, for example, be most convenient to have all modification of milk done at a specialized dispensary in one district. In Cleveland, Ohio, a district plan is in operation, but all sick babies are sent to a Central Dispensary of the Babies' Hospital. There also is found an excellent example of coöperation between the health department and unofficial organizations.[1]

8. Dispensation of *milk* should be carried on in such a

[1] Report of the Babies' Dispensary and Hospital, Cleveland, Ohio, for year ending Sept. 30, 1912, p. 19 ff.

manner as not to encourage bottle-feeding, but simply with the object of supplying a high grade of milk, in those cases where needed, at a reasonable cost. This milk should be given out in the whole form and the mothers taught home modification, except in cases of incapacity or illness of the mother which make it necessary to modify at the milk station.[1] Where the health department is able to specify certain milk supplies on the market as being of sufficiently high and reliable grade to meet approbation for infant feeding (and this of course should be the case), such supplies, delivered at the homes in the usual manner, may take the place of dispensary milk. Where the grading of market milk is carried out this may readily be the case. It must always be remembered that the functions of oversight and instruction, beginning in the prenatal period and extending through early infancy, and not merely milk distribution, are the chief objects of the infant welfare station.

The following quotation describes very specifically what can be done in the way of organization in *small towns and cities*.

If there is one hospital, one charitable society and one or more churches in a town doing social work, we immediately have the nucleus for a small babies' welfare association, and we believe that the lesson in the possibilities of coöperation under the greatest of difficulties, learned in New York City, can be applied in modified form in smaller communities much more easily. Stamford, Connecticut, for instance, a city of 15,000 inhabitants, has one hospital, a visiting nurse's association and an association of charities, which includes a number of churches, lodges and other societies. From these few elements they have decided that they can profitably organize a babies' welfare association something along the line of that tried successfully in New York City.

Any village or city of over 5000 inhabitants might profitably establish a milk station, or, even better, a child welfare center in which educational work alone is conducted, if the general milk supply of the community is of a high enough grade, and does not merit the special

[1] See remarks on p. 310 f.

dispensing of pure milk. As an example, the experience of Englewood, N. J., might be cited. This town has only about 10,000 inhabitants, but as a result of an influx of a foreign element the infant mortality rate became very high. A small cottage was rented and a dispensary and baby shelter established where the nurses in attendance gave instructions to mothers on the care of their babies. The doctor in charge treated all diarrhœal cases and two or three beds were provided where babies could be kept temporarily in case their mothers were sick. At the same time pure milk was sold, at a moderate cost, to the mothers who needed to give their babies artificial feeding. As a result the Englewood infant death rate was effectively cut down. It now has one of the lowest death rates of any community of its size in the State of New Jersey.

In smaller villages where a station could not be run to advantage, and where milk dispensing is not necessary, educational work can be and is done, successfully, by a single visiting nurse. Even in hamlets and rural communities a church society can provide a fund from which a local nurse can be hired temporarily, whenever there is a family in need of such work.

The same suggestions can be made regarding prenatal work as regarding milk station work in smaller communities. We believe the work can be carried on in larger cities, by districts, just as it is carried on in New York City. In smaller communities any visiting nurse or organization employing visiting nurses can profitably take up this effective and not costly effort to save infant lives and reduce not only mortality but morbidity.[1]

As the result of careful study of the needs of the city of Newark, N. J., and the work begun there under unofficial organization, the following conclusions of general interest were reached:

Infant consultation stations are less expensive and more efficient than milk depots.

All mothers can be taught to prepare milk for their infants at home.

[1] Dr. Pisek, Medical Director, New York Milk Committee, "The Health Officer's Place in the Campaign for the Reduction of Infant Mortality," in Special Bulletin of N. Y. State Dept. of Health on Infant Welfare Conference, June, 1913. See also other papers in same, esp. Clarke, "Infant Welfare Work in Small Cities." This bulletin and the one on Infant Welfare Stations in New York State, also issued by the New York State Dept. of Health, contain a great deal of value to the health officer concerned in the establishment of infant welfare work.

Pure milk can be obtained for babies at a price within reach of all.

The mortality of infants under one year of age is exceedingly high in all institutions.

Infants deprived of mother's care should be placed out in properly supervised private homes.

Ignorance is the greatest single factor in infant mortality.

Education of mothers and the supervision of babies cause the greatest reduction of infant mortality.

The prompt and accurate notification of births is necessary to enable us to prevent the great mortality of the first week of life.[1]

Midwives can become a great force in the education of our foreign-born mothers in infant hygiene through active and careful supervision.

The reduction of infant mortality can best be accomplished by the establishment of a municipal department of child hygiene.[2]

In some communities it has been found feasible to combine the instructive nursing work with other similar work. Thus in a number of places (e.g., New York City, Syracuse, N. Y., *et al.*) the school nurses have done infant welfare work during the summer months. In other small towns (e.g., Montclair, N. J.) one nurse has been employed for both tuberculosis and infant welfare work. Such expedients are useful where full-time nurses cannot be secured.

Summer Campaigns or All-the-Year-Round Work? — In most places where infant hygiene work has been taken up it had its inception with a summer campaign. And it is true that the summer season is the most severe on infant life, for in some cities one-third to almost one-half of the whole infant mortality occurs in the third quarter, i.e., July to September inclusive. But it should not be supposed that little or no work is needed during the winter months. During those months there occur many deaths from preventable causes; the deaths from diseases of the respiratory system are numerous, while the steady succession of deaths

[1] Prenatal work may also be undertaken with this object. — J. S. M.

[2] Rpt. on "The Work of the Public Welfare Committee of Essex County [N. J.] for the Reduction of Infant Mortality," by Dr. Julius Levy, 1912. Issued by the Committee at 665 Broad Street, Newark, N. J.

due to prenatal causes and improper care at and just after birth goes on steadily irrespective of season. Moreover, the educational character of the work requires that it be carried on continuously in order to take root and gain continued confidence. Thus, too, skill and attachment on the part of nurses is obtained. Hence, while summer campaigns alone accomplish an immense amount of good, an adequate plan involves nurses and consultation stations steadily at work all the year round.

Costs and Results. — The costs of infant welfare work will depend somewhat on local conditions. The salary of a trained nurse is usually \$65 or \$75 a month. Rooms suitable for welfare stations are obtainable in the poor districts where they are usually located, at a low rental. Rooms in public schools, settlements and the like solve the rent problem completely. The equipment needed for an ordinary station is comparatively inexpensive, and requires little in the way of renewal. Where a special supply of milk is desired it can usually be obtained, by arrangement, of proper quality and at a price not exceeding that of ordinary market milk. This milk may be dispensed from the station or arrangement may be made whereby the dealer delivers to the homes. This part of the work need not involve charity, for in almost all cases the families should be able to pay the full cost price.

The average total maintenance cost per baby, per month, is given for certain stations in New York State which were operated during the summer, as \$1.04, including the equipment in the majority of cases.[1]

As for results, it must be noted that the work is primarily educational, and since education is a gradual process, immediately conspicuous results in the general infant mortality rate should not necessarily be expected. A detailed study of the work in the districts where it has been carried on should disclose some results even during the first season.

[1] See p. 326.

Dr. Josephine S. Baker, of the New York City Division of Child Hygiene, at the New York State Conference already mentioned, stated that "for the four years previous to 1908 in New York City the death rate of babies under one year of age ranged from about 160 to 164 per thousand; in the four years since 1908 that death rate has been reduced from 160 to 105 per thousand." This as the result of infant hygiene work carried on by the New York Milk Committee and other unofficial organizations in coöperation with the Division of Child Hygiene of the Department of Health. The New York Milk Committee has made a special and detailed study of the infant welfare work carried on in the ten largest cities of the United States, as the result of which the following conclusions, all applicable to work in small communities as well, are given:

1. The reduction of infant mortality in 1911 in the cities studied was very marked, especially during the summer months. During the first part of the summer meteorological conditions were not favorable to a low mortality.

2. This reduction was not due to chance, but bears a close relation to the activity of the campaign for the reduction of infant mortality. The difference between cities in infant mortality rates is probably more a matter of public conscience and quality of official endeavor, than weather and character of population.

3. The full effects of any campaign will not be seen immediately. Dr. Robertson, Health Officer of Birmingham, England, said at the conference at Caxton Hall that he would be satisfied if he got results after ten years' work.

4. In the education of the mother in the care of herself and her baby we have the strongest weapon for fighting infant mortality.

5. The results in the milk stations, as shown by the detailed histories of 3182 babies, have proved the usefulness of the milk station in the reduction of infant mortality. It is one of the most efficient forces in the educational prevention of sickness and deaths among babies.

6. Its field of usefulness can be very greatly extended into other branches of infant and child welfare, such as prenatal work; the care of children under school age; follow-up work in inspection of school-children; supervision of boarded-out babies and midwives, etc. Stations should be maintained all the year around in order to make their value cumulative.

. . . .

9. Compulsory attendance under penalty of stopping milk supply should be insisted on.

10. When efficiently managed, the milk station is an economical means of forwarding the movement for infant welfare.

11. The results of the methods employed at the Committee's milk stations prove conclusively the entire feasibility of teaching home modification of milk, thus not only doing away with expensive laboratory plants, but making the mother eventually independent of the station.

12. The milk station can and should be a valuable means of encouraging and making possible maternal nursing. It need not be an encouragement to artificial feeding.

13. Private agencies are warranted in initiating milk station work, but their program should provide for having the municipality assume charge as soon as practical. The activities which are possible for the stations are proper functions for the municipality. Close coöperation between health authorities and private organizations is entirely feasible and necessary.

14. The education of the "little mothers" in the care of the baby will insure not only immediate results, but will pave the way for better motherhood.[1]

Other examples may readily be found to illustrate the results of infant hygiene work carried on in small cities. In Orange, N. J., the dispensing of milk had been carried on for some years by a private organization. In 1911 another organization raised additional funds and placed in the field, working as a special inspector under the supervision of the Health Officer, an infant welfare nurse. In the Report of the Health Officer for 1912, the first full year that the nurse was at work in coöperation with the Health Department and unofficial organizations, the following remarks appear:

The low record of mortality obtained among the cases under supervision of the nurse is a gratifying result which demonstrates the value of the preventive measures adopted. Eleven of these cases died [de-

[1] Special Rpt. "Infant Mortality and Milk Stations," 1912, p. 129. Cf. statistical survey of results of consultation stations and milk distribution in various French and American cities by Freeman, "Infant Milk Depots," Proceedings Conf. on Inf. Hyg., Rpt. Phila. Milk Show, 1912, p. 191.

tails set forth in table]. Cases Nos. 3, 4 and 11 died from non-preventable causes. . . . In most of the other cases only a small number of visits had been paid; for instance, in two cases there had been but one visit, and in two others two visits. In several instances there was little coöperation on the part of the mother.

In order, however, to make the most conservative possible calculation, all of the above eleven deaths are taken as the mortality among the 450 cases under supervision. This gives a percentage of 2.4, which, however, should be corrected for the fact that the cases were not all under observation the whole year, but only for an average of 121 days. The corrected death rate would then be *7.4* per cent per annum. This rate, if compared with the infant mortality rate for the city for 1910 and other years preceding inception of the nurse's work (average about *11.5* deaths under one year per thousand births), shows . . . the marked reduction which the work of the nurse effects. Nearly the same reduced death rate (6.8 per cent) had previously resulted among the infants under supervision in 1911. . . . The benefits . . . through the saving in vitality and the prevention of disease and weakliness, both in babyhood and in later life, though not susceptible of demonstration by figures, are also obviously of immense importance.

It is to be noted that the above results were obtained in the first two years of the work and with incomplete organization. With improved organization and the cumulative effect of education of mothers and "little mothers" the estimate, based on statistics, that at least 50 per cent of the deaths which occur in the first year of life can be saved by infant welfare work, will doubtless be fully borne out; although in this instance it must be remembered that a substantial amount of infant hygiene work was already being carried on by a diet kitchen and other organizations when the infant welfare nurse began her work. It may be a source of encouragement to other small cities to know that in the above instance the municipal council, persuaded by the results obtained under private efforts, appropriated to the health department a sufficient sum to carry on the entire work of the nurse under an improved system of organization. This is merely an example of what may be done in many American communities.

When funds for the work are limited, as is very frequently the case, the work should not be spread out "thin" over an excessively large number of cases, but should be concentrated so as to get results which may be used as a basis for obtaining increased financial support. The natural limits of control should not be exceeded.

In calculating statistical results and making comparisons with annual infant mortality rates (deaths under one year per thousand births), the rates calculated for infants under supervision should be reduced to an annual basis to correspond, as is done in the quotation above; otherwise the comparison is fallacious and will lead to erroneous and extravagant conclusions. Thus, if the average duration of supervision of cases is 121 days, or $\frac{121}{365}$ of a year, the death rate among these cases should be multiplied by $\frac{365}{121}$ to reduce it to a per annum rate. Again, when the infant mortality rates from year to year are compared, it is to be remembered that improved birth registration, by increasing the denominator of the ratio, tends to make the rate apparently lower, independently of actual change in mortality.

In conclusion we revert to the statement quoted at the head of this chapter, that child — especially infant — hygiene work is a requisite function of every well-organized health department. While in most instances such work has been thus far initiated and its value demonstrated by unofficial organizations before being assumed by public authorities, the time has now come for those authorities themselves to take the initiative in obtaining funds and organizing the work. The work of the unofficial organizations already in the field should thus be coördinated, supplemented, and, so far as advisable, officially adopted. In this development the idea of charity will be more and more removed from the main phases of the work and its

influence correspondingly extended. Thus health authorities stand in infant hygiene work just where they stood in relation to tuberculosis work a few years back, and the assumption of the former by them should be, in the light of advancing knowledge, even more rapid than that of the latter. The fact that success in notable measure has been achieved in those larger cities which have led in sanitary organization is the impetus for the extension of similar methods to the smaller cities and towns, where problems of organization are simpler — nay, even to the most rural communities, where the need is nearly if not wholly as great.

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CHAPTER III

MILK AND OTHER FOOD SUPPLIES

I. MILK

Milk is by far the most important food with which the health official has to deal. On the one hand it is one of the most valuable, cheapest and most extensively used foods, particularly for infants and young children; and on the other, it is specially subject to contamination and deterioration. Again, while the sanitary regulation of milk supplies demands the most serious attention, there are also economic problems in connection with milk as a market commodity which are closely interrelated with those of a hygienic character.

GENERAL REQUIREMENTS

We may promise the following requirements for a safe and satisfactory milk supply, viz., it must be:

1. From healthy cows.
2. Drawn and handled in a cleanly manner.
3. Free from deleterious bacterial decomposition.
4. Unadulterated and of a sufficient food value.
5. Free from infection from human or animal source.

Of these requirements the last-named is the most important, but depends in a great degree upon the first three. We shall take up these requirements in detail and explain just what is implied by each.

1. **The supply must be obtained from healthy cows.** — This requirement implies freedom of cows from udder disease, from at least clinically detectable tuberculosis, and

from other diseases transmissible from animal to man. All these will be taken up presently under the head of infection.

2. **The supply must be drawn and handled in a cleanly manner.** — Milk is highly susceptible to contamination and has the peculiar property of not showing the dirt which it may have taken up, even when the contamination is heavy. At every stage, from the cow to the ultimate consumer, there are numerous possibilities of contamination, from dirty cows and stables, from dirty methods of milking and handling, from dirty utensils and dirty fingers. At the stable a great deal of the contamination is with manure (containing the colon bacillus and other bacteria and frequently the bacillus of bovine tuberculosis). At all stages the contamination consists in miscellaneous kinds of dirt and filth, with the constant possibility of infection by communicable disease. Contaminations are not only in themselves bad, but they are the starting point of various bacterial fermentations which tend to make the milk an unfit and possibly a dangerous food, particularly for young children.

3. **The supply must be free from deleterious bacterial decomposition.** — Milk kept insufficiently cold or too long undergoes decompositions of various kinds due to the action of the bacteria present upon the organic food substances of the milk. Since it is physically impossible, even with the greatest precautions, to obtain and keep a bacteria-free milk, the only safeguard against decomposition is to keep the milk at a low temperature (below 50° F. for market milk) and to consume it as soon as practicable after production. These decompositions are either acid or alkaline in character. The former lead to the ordinary souring of milk, are more common, take place quickly when milk is allowed to remain warm — i.e., at 70° F., or above — and are the less dangerous variety. This is the variety of fermentation made use of for obtaining sour milk for special purposes, in which case, however, the milk should be specially prepared and inoculated with a known organism.

The alkaline decompositions usually take place at lower temperatures and lead to putrefactions which are exceedingly dangerous. This is the case with milk which has been pasteurized at a high temperature so as to kill off the lactic acid bacilli (acid fermenters) and which is afterwards allowed to decompose through lack of sufficient refrigeration.

In the *prevention* of bacterial decomposition the maxim that milk should be *clean, cold and fresh* covers the essential requirements. It must be noted, however, that a certain limited number of bacteria may be present without producing any deleterious fermentation, provided the above conditions are practically observed. But a milk that is either *dirty, or warm, or stale* must always be looked upon as a dangerous product.

Contaminated and decomposed milk has, as we saw in the last chapter, a special bearing on infant mortality. The following passage sums up the common opinion of authorities.

> There is no specific germ that causes malnutrition and the gastro-intestinal troubles of infants. It is the general observation that the presence of streptococci and colon bacilli in milk does augment these disorders. Excessive numbers in milk of any germ, even those at times considered to be harmless, has been found also to be productive of these troubles. The presence of colon bacilli is the source of great danger to children.
>
> *The effects of contaminated milk* have been shown by the prevalence of diarrhœal diseases and the occurrence of numerous cases of malnutrition amongst infants raised upon cow's milk. One has but to observe the mortality tables during the summer months and compare the bacteriological reports of milk ordinarily used for infant feeding to be convinced of the direful influence of such milk.[1]

A striking example of the *benefits of milk improvement* where the subjects were adults is given in the annual report for 1912 of Dr. A. D. Melvin, Chief of the Federal Bureau of Animal Industry, who states that through improvement

[1] Magruder, pamphlet cited on p. 397.

of the milk supply of the U. S. Naval Academy at Annapolis, Md., gastro-intestinal disorders among the midshipmen were reduced from 133 to 25 per month. If this is the phenomenon observed among healthy adults, what must be the effect of bacteria-laden milk supplies on the delicate organisms of infants, young children and invalids!

Since cow's milk must be used to a considerable extent in the artificial feeding of infants, in whole or in part, and to a very large extent among all children from one year up, the magnitude of this phase of the milk problem is evident.

4. **The supply must be unadulterated and of sufficient food value.** — Since milk is of a naturally variable composition and the consumer has no exact way of knowing what its food value is, standards should be set for percentages of fats and total solids. Such standards must be adapted to the percentages found in the milks of different kinds and grades of cattle, their principal object being the protection of the consumer against watering, skimming and other frauds. This is the class of food laws which protect against fraud perhaps even more than against damage to health. However, the richness of milk has a distinctly important public health bearing, particularly when there is question of modifying milk and feeding infants. The addition of preservatives, in themselves deleterious and also highly objectionable as covering up — but not removing — decomposition, falls under the same class of prohibition.

5. **The supply must be free from infection from human or animal source.** — Milk not only readily takes up infection in the course of production and handling but also may act as a culture medium in which pathogenic organisms actually multiply. Hence we find on record hundreds of epidemics which have been traced to milk supplies, in addition to which there are thousands of cases, occurring sporadically or in epidemics, which have escaped such recording. This aspect of the milk problem overshadows the others in importance. Now that milk is frequently handled on a large

scale, the damage that may be done by a single infection of a milk supply is enormous. Several years ago one of our large cities experienced an epidemic of 1000 cases of typhoid fever from a single source of infected raw milk. Other cities and towns, small as well as large, have from time to time suffered more or less severe milk-borne epidemics of various diseases; under present conditions none are immune. The presence of carriers and missed cases among employees connected with milk supplies very seriously aggravates the danger.

Diseases of Human Origin. — The principal diseases of human origin of which milk may act as a vehicle are: *typhoid fever and other intestinal diseases*, *diphtheria*, *scarlet fever and septic sore throat.*[1] We shall not here discuss this important subject further, but refer the reader to the section on epidemiology (pp. 266–92) where further examples and details are given. In the present section the prevention rather than the occurrence and characteristics of milk-borne epidemics will be considered.

Diseases of Animal Origin. — The principal milk-borne disease of animal origin is *bovine tuberculosis.* It is now well established through extensive researches that although the bovine tubercle bacillus is apparently distinct from the human type, bovine tuberculosis may be, and in a certain proportion of cases is, communicated to man through milk. Tuberculous cattle excrete the bacilli in great numbers in the feces, and particles of manure getting into the milk at time of milking infect it; this is the commonest source of tubercle bacilli in milk. This is true even with cattle which give no physical signs of the disease; in these cases the diagnosis can only be made by means of the tuberculin test. (For discussion of the test and of the relative numbers of dairy cows which are found to react to it, see following section.)

[1] In some epidemics septic sore throat has been attributed to udder disease in cows and in others to human carrier cases.

As to the *amount* of human tuberculosis of bovine origin, we can only allude briefly to the estimates which have been made by various authorities, calling attention especially to the researches of the British and German Commissions and of Park and Krumwiede of the Research Laboratory of New York City.

"It is now estimated," according to Rosenau, "that perhaps 7 per cent of the tuberculosis in man is of bovine origin."[1] The great bulk of the human tuberculosis bacteriologically identified as bovine is in the form of generalized, abdominal and glandular tuberculosis of children. In a summary of the researches Rosenau[2] states that "about one-quarter to one-half of all cases of tuberculosis in children under 5 years of age is associated with the bovine type," probably derived in all cases from cow's milk. Park has estimated, on the basis of the various available researches, that in New York City:

> About 7 per cent of the infants and young children under 5 years of age *dying* from tuberculosis do so because of infection derived from infected milk or milk products. Fatal tuberculosis due to bovine bacilli is rare in those over 5 years of age, but, on the other hand, infection of the lymph nodes is frequent; 30 per cent or more of tubercular lymph nodes occurring in children between 5 and 16 are contracted through bovine bacilli. Judging from the 296 cases examined, pulmonary tuberculosis is practically always due to the human type, that is, contracted from other cases, and not from milk.[3]

Applying Dr. Park's figure to the percentage of deaths from tuberculosis under five years of age in the Registration

[1] "Preventive Medicine and Hygiene," 1913, p. 124.

[2] *Loc. cit.*

[3] "The Rôle of Bovine Tuberculosis in the Production of Human Tuberculosis," *Trans. XV Internat. Congress on Hyg. and Demogr.*, 1912, vol. IV, pp. 267–72 (an admirable summing-up of the whole subject). It is scarcely necessary to note that (as implied by the word which we have italicized above) the many cases of tubercular infection which do not result fatally should be considered in addition to the above estimate.

Area (approximately 7 per cent of the total tuberculosis), would give about one-half of 1 per cent of all tuberculosis deaths as definitely due to the bovine type. Ravenel[1] believes that there is a possibility of the bovine bacillus changing its type after becoming rooted in the human subject, which, if true, would make the numbers of cases of bovine origin in excess of the apparent figures. This, however, has not, it appears, been demonstrated.

There is reason for believing that all persons are infected with the bovine bacillus in infancy through the ingestion of cow's milk, but that the development of immunity in the great majority of cases prevents the development of the disease. From the figures just quoted it is to be seen that the actual proportion of human tuberculosis from bovine sources which has thus far been demonstrated is not great as compared with the total from all sources. The absolute numbers of cases, however, may be considerable. Below will be considered what measures may be adopted to avoid them.

The Tuberculin Test. — The tuberculin test[2] is accepted as the standard test for tuberculosis in animals when the disease cannot be definitely detected by physical examination. The International Commission on the Control of Bovine Tuberculosis resolved in 1910 that "tuberculin, properly used, is an accurate and reliable diagnostic agent for the detection of active tuberculosis;" a decision affirmed legally by the opinion of the court in the Montclair and other cases.[3]

[1] See discussion of Dr. Park's paper just cited.

[2] The test consists in the hypodermic injection into the suspected animal of a measured amount of an emulsion of killed bovine tubercle bacilli (tuberculin). The temperature of the animal is taken at certain intervals for some hours afterwards; animals having tuberculous infection "react" by a marked rise in temperature. The tuberculin reaction has been accepted legally, as well as in veterinary medicine, as a thoroughly reliable test when in proper hands. See decision in Montclair case, Appendix C.

[3] See Appendix C.

Officials of the U. S. Department of Agriculture[1] have demonstrated that tuberculous cattle discharge tubercle bacilli in their feces, the chief source of these being the sputum of the animals, which, after being coughed up, is swallowed and passes through the alimentary canal without the bacilli losing their virulence. They showed, furthermore, that "the cattle that pass tubercle bacilli per rectum are not always visibly diseased. Many apparently healthy but tuberculous cattle which are not known to be tuberculous until they are tested with tuberculin, intermittently pass tubercle bacilli from their bodies per rectum with their feces." In some cases the germs may also get into the milk directly from tuberculosis of the udder.

In Appendix C will be found a review of the Montclair and other cases by which the powers of health authorities to require that milk, as judged by this test, be tuberculosis-free, are supported.

Evidence from four typical American cities, summed up by Rosenau,[2] shows that out of a total of 551 samples of market milk examined tubercle bacilli were found in 46, or 8.3 per cent, a figure which may be taken as an approximate percentage for the country. Even this figure is doubtless an underestimate, for the laboratory methods do not always detect bacilli which are present only in small numbers. In Rochester, N. Y., among 185 retailers 12.65 per cent of the milk samples examined reacted positive to animal tests for tuberculosis.[3] Unfortunately such tests give no indication as to the numbers of tubercle bacilli in the samples.

A serious *economic question* arises when the tuberculin test is applied to dairy cattle and it is proposed to eliminate the milk of reacting animals from the public supply. Some idea of the relative numbers of reactors is given by the

[1] Shroeder and Cotton, Bulletin 99 (1907) and Circular 118 (1907), Bureau of Animal Industry, Dept. of Agriculture.

[2] "Preventive Medicine and Hygiene," 1913, p. 513.

[3] Goler, *2nd Ann. Trans. Am. Assn. for Study and Prev. of Infant Mortality*, 1911.

experience of Montclair, N. J., when its tuberculin-test ordinance went into effect in 1907:

> Of the New Jersey cows that had not been previously tested, 25 per cent reacted. Many of the figures that are available on the subject . . . relate to suspected or picked herds, whereas the percentage of reactions above mentioned represents conditions of herds taken practically at random over a considerable area, with the exceptions that they had more than the average veterinary inspection, and that they have been stabled under good conditions.[1]

In individual herds a quarter to a half or even three-quarters of the animals may react. The enforcement of such a regulation would result in a serious diminution of the herds, a large financial loss to the dairymen and a great lessening in milk supply with a resultant increase in cost of the product. This problem has been met in some instances, e.g., New York State, by legal reimbursement of the owner for a large part of the loss sustained by the slaughter of tuberculous cattle. However the loss is met, it is a real loss; if private, it means injustice to the cattle-owner; and if public, it must result in a higher real cost of milk supplies, whether paid through taxes for reimbursement of dairymen for rejected cattle or through an increased price for market milk.

The milk from cattle having tuberculosis to an extent detectable by ordinary physical veterinary examination should be excluded. But when there is question of the use of milk from cows, apparently healthy, which simply react to the tuberculin test, then there is, as will be shown below, a practical *alternative* to elimination of the milk from these animals, viz., pasteurization. If, however, milk is to be consumed raw (e.g., certified milk), then it can only be protected from tuberculosis by enforcing the tuberculin test.

It scarcely need be said that the elimination of tuberculosis in dairy herds by scientific methods constitutes a large

[1] Wells, "The Successful Efforts of a Small City to Secure a Milk Supply from Tuberculin-Tested Cows," *Am. Jour. Pub. Health*, 1912, vol. II, no. 9, p. 702.

economic problem for veterinarians and dairymen, quite apart from considerations of human hygiene.

Other diseases transmissible to man through milk, but occurring comparatively infrequently, are:

Milk sickness, an acute, non-febrile disease due to the ingestion of milk, milk products, or the flesh of animals suffering from a disease known as trembles. The disease is characterized by great depression, persistent vomiting, obstinate constipation and high mortality.

Foot-and-mouth disease, an infection primarily of cattle and secondarily of man. In man the disease is mild and the symptoms resemble those observed in animals.

Malta fever, transmitted from goats to man through milk.

PASTEURIZATION

Definition. — Pasteurization is the term applied to any process of heating milk (or other substance) to a sufficient temperature and holding it at that temperature sufficiently long to destroy nearly all the germs present. If the process is properly performed any disease-producing germs present are killed, the surviving organisms being harmless varieties. It has been shown that all of the lactic acid germs, which cause the souring of milk, need not be destroyed; this has an important practical bearing, for if the care of milk after pasteurization chances to be neglected it is highly desirable that it should sour rather than undergo a very much more dangerous alkaline decomposition with production of ptomaines and the like. (See previous remarks under head of bacterial decomposition.)

Pasteurization should not be confused with sterilization. Sterilization means the destruction of all germs, and requires heating to the boiling point. (Perfect sterilization requires such treatment on three successive days.) There are great differences between the chemical changes which take place in milk heated to various temperatures for various lengths

of time, and these have been the cause of dispute and misunderstanding through failure to make use of exact definitions. Pasteurization is a general term covering various processes having a similar effect, and being thus general, should be defined for purposes of practice and discussion. The Commission on Milk Standards of the New York Committee [1] (2nd Report) reports on the subject of pasteurizing temperatures as follows:

> The commission passed a resolution regarding the temperature of pasteurization as follows:
>
> *That pasteurization of milk should be between the limits of 140° F. and 155° F. At 140° F. the minimum exposure should be 20 minutes. For every degree above 140° F. the time may be reduced by 1 minute. In no case should the exposure be for less than 5 minutes.*
>
> In order to allow a margin of safety under commercial conditions the commission recommends that the minimum temperature during the period of holding should be made 145° F. and the holding time 30 minutes. Pasteurization in bulk when properly carried out has proven satisfactory, but pasteurization in the final container is preferable.
>
> It is the sense of the commission that pasteurization in the final container should be encouraged.

The definition italicized above should be adopted by health authorities for all practical purposes and the added recommendation should be observed by milk dealers. Proper pasteurization does not affect the taste or chemical characteristics of the milk, nor does it prevent the rising of cream, though higher temperatures or greater lengths of time may do so.

Contrary to opinions which have been expressed by some in the past, *proper pasteurization does not exert any deleterious influence upon the chemical or nutritive value of milk.*[2] Even boiled milk is apparently exonerated by recent investiga-

[1] See p. 362.

[2] Kastle, Bull. 56, Hyg. Lab. U. S. Pub. Health Service, and Rupp, Bull. 166, U. S. Bureau of Animal Industry (quoted by Magruder, ref. at close of this chapter).

tions from the accusation of producing adverse effects in infants and young children.[1] Rosenau states that "the evidence seems clear to me that these two diseases [scurvy and rickets] bear no relation whatever to the heating of the milk."[2] So much for the clinical and prophylactic aspects of the case.

The Argument for Pasteurization. — The administrative argument for pasteurization is based upon the fact, proved over and over again, that *proper pasteurization of milk supplies is the only certain safeguard against milk-borne infectious disease.* Even with the most careful and frequent inspection and the promptest and fullest reporting of cases by physicians it is impossible to guard against the infection of milk supplies by carriers, missed cases and incipient cases of typhoid fever, diphtheria, scarlet fever, septic sore throat and other communicable diseases. Such cases are certain to occur from time to time among persons engaged in handling milk at the different stages, in the families of dairymen, etc. Against this certainty, which is only a matter of time, communities using raw milk are taking a chance which on any day may prove fatal. These considerations are concurred in by all authorities on the basis of hundreds of recorded outbreaks which have already occurred. In a number of such instances it has been shown that even great cleanliness, as ordinarily understood in the production and handling of milk, while diminishing the chances of infection, has by no means prevented infection; even certified milk supplies have not escaped infection.

Again, through pasteurization, infection from animal sources, and particularly bovine tuberculosis, is absolutely eliminated. Not only is safety thus obtained, but a great economic saving is effected, since the milk of those (otherwise healthy) cows which react to the tuberculin test may be safely used when it has been pasteurized. The elimina-

[1] Magruder, *op. cit.*

[2] "Preventive Medicine and Hygiene," 1913, p. 519.

tion of tuberculosis among cattle involves difficult problems and will not be accomplished for many years to come. But, fortunately, *instead of the destruction of non-tuberculin-tested cattle, pasteurization of milk may* (*and should*) *be required*. This, assuming that the pasteurization is properly performed under adequate official control (see below), is the practical solution of the problem.

Finally, through pasteurization, germs — other than those of the above-mentioned diseases — which abound even in milk produced under what are regarded as moderately good conditions, are destroyed and thus is the milk rendered in general *a far safer food for infants, young children and invalids*, with the result of a corresponding reduction in the occurrence of gastro-intestinal disorders and an increase in vital resistance to other diseases. A large number of authorities might be cited to illustrate this point. Researches conducted in connection with the Rockefeller Institute of Medical Research have shown, in the words of Dr. W. H. Park of the New York City Department of Health, "that mother's milk is the best milk for a baby and that pasteurized milk is the next best." This was proved by the fact that babies changed from pasteurized milk to good raw milk became ill.[1]

It has been remarked that pasteurization is not an "ideal" measure. The question, however, is one of expediency, and since it is a practical impossibility to secure infection-free and low-bacteria raw milk supplies, this method must be adopted to destroy bacteria and infection. This "purification" of milk supplies is analogous to the purification of water supplies, with the difference that originally safe

[1] Cf. Straus, "Saving Children from Milk-Borne Diseases," *Am. Jour. Pub. Health*, 1911, vol. I, no. 2, p. 109, and "Disease in Milk — The Remedy: Pasteurization," by Lena G. Straus, New York, 1913 (both describing methods used and results obtained in the dispensing of pasteurized milk from the celebrated Straus stations in New York City); and papers in *Trans. XV Intern. Congress Hyg. and Demogr.*, 1912, vol. IV.

water supplies may frequently be obtained, whereas this is not true of milk supplies.

The case for pasteurization may be closed by remarking that the Commission on Milk Standards to which we have already alluded has recommended unanimously that *all milk* be pasteurized with the possible exception of that of the very first grade (Grade "A") — which constitutes in any case but a very small proportion of the whole milk supply — and the majority of the commissioners voted in favor of the pasteurization of all milk including even this class.

Cautions in Connection with Pasteurization. — The so-called objections against pasteurization may be mentioned here simply as cautions. It is truly said that pasteurization may be used as a cloak for bad milk, in efforts to redeem bacteria-laden milk which would otherwise be unsalable. The heating process, while destroying bacteria, does not remove the products of bacterial decomposition. Filth in milk, though pasteurized, is none the less filth. Hence *pasteurization can in no way take the place of precautions as to cleanliness and handling.* Inspection work should not be diminished but rather increased when pasteurization is employed. This is not an objection but simply a precaution in connection with the process. As Ayres has remarked, the object is not to try to make a dirty milk a clean milk (an impossibility) but to make a clean milk a safe milk.

Another caution, relating to the adequacy of the process, will be taken up in the next paragraph.

Control. — *Pasteurization is a scientific process which should be carried out under expert management and under official supervision.* Commercial methods should be thoroughly inspected and approved before the designation "pasteurized" is permitted to be used, and then should be as frequently as possible reinspected. Automatic temperature regulators and recording thermometers should be

required in plants, and the processes should be checked by frequent bacteriological tests. Much harm has been done by the exploitation as pasteurized of improperly treated milk.

Methods. — In some countries it is the custom of the people to heat or boil the milk used for domestic purposes, with beneficial results in the avoidance of infection, etc. And at the present time, wherever public milk supplies are not commercially pasteurized before delivery, the private family may protect itself by home pasteurization, which we have already described.[1] This, however, is not satisfactory any more than reliance upon the public to boil contaminated public water supplies; it is not altogether simple, cannot be taught on a large scale and is beyond the intelligence or willingness of many people. The only adequate measure is the requirement of pasteurization of all commercial milk supplies under close official supervision.

The two methods in common commercial use are the *flash method* and the *holding method*. In the former the milk is run over hot pipes and heated to a high temperature for a very short time — say one-half to one minute. In the latter the milk is raised to a lower temperature but held in tanks for a much longer time; 140° F. for 20 minutes or more would constitute a proper pasteurization according to this method. Experiment has shown that the flash method is not satisfactory, does not always produce the required bacterial reduction, and is subject to grave variations. Hence it is excluded by the definition of the Commission on Milk Standards which we have quoted, and should not be allowed. Reliable dealers use holding machines with automatic devices which absolutely insure the proper temperature and length of time, using a temperature of 145° F. for 30 minutes. "By the holding process properly conducted it is usual to destroy 99.93 to 99.99 per cent of the bacteria" (Magruder). Regulation should

[1] P. 311.

regard the final count, though the initial count before pasteurization should also be subject to control (see Rules, Appendix B). Since all the bacteria are not killed it is essential that pasteurized milk be promptly cooled as held at as low a temperature as raw milk would be (50° F. or below — Commission on Milk Standards). Furthermore, the greatest cleanliness should be insisted upon in pasteurizing plants and the apparatus should be cleaned and sterilized with live steam daily in order that there may be no contamination of the milk before or after the process; and the milk should be immediately run into sterilized bottles.

The process most recommended by sanitarians, though it has some practical difficulties, is *pasteurization in the final container*. This has the great advantage of allowing no contamination subsequent to the process and before delivery to the consumer. The bottles must have water-tight seal caps and are immersed in hot water, held for prescribed temperature and time (say 145 degrees for 20 to 30 minutes), and cooled by lowering of the temperature of the surrounding water. The economic drawback is the cost of the caps. Care must be taken that the whole mass of milk in the container is heated and held sufficiently. As a practical modification it has been suggested that milk be pasteurized according to the holder system and then be run while hot into bottles which have just been steamed. In this case ordinary caps could be used and the bottles could be cooled by a cold air blast. Further data are to be looked for in the study of this process, looking toward its adaptation to commercial use.[1]

[1] Ayres, "The Present Status of Pasteurization," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 1, p. 15. Cf. Bulls. 166, 126, 161, and especially 184, Bureau of Animal Industry. Other details of pasteurization methods are given by North, "The Holding Method of Milk Pasteurization," *Eng'g News*, 1910, vol. 63, no. 19, p. 570; Kilbourne, "Pasteurization of Milk, with Suggestions as to Methods and Apparatus to be Employed," *Am. Jour. Pub. Health*, 1912, vol. II, no. 8, p. 626; Kilbourne, "The Control of Temperatures in the Pasteurization of Milk," *Am. Jour. Pub. Health*, 1913, vol. III, no. 3, p. 268.

Other methods of purification of milk have from time to time been proposed. Thus good results from partial sterilization by electricity have been reported (Liverpool, 1913). But none of these have thus far, so far as the writer knows, proved as economical and practically effective as pasteurization, and none are in general use.

THE REGULATION OF MILK SUPPLIES

The *objects of regulation* may, for convenience, be recapitulated as follows (cf. page 345):

1. The competent veterinary examination of dairy cattle and elimination of those shown on physical examination to be diseased.

2. Cleanliness of stables, animals, utensils, etc., and especially of methods of production and handling, all along the line from the cow to the consumer.

3. Maintenance of the milk continuously at a sufficiently low temperature. Prohibition of the sale of stale milk and milk showing an excessive bacterial count.

4. Sufficient food values and freedom from adulteration (as through watering, skimming and the like), sophistication and the use of preservatives.

5. Prevention of infection, human or animal in source, through requirements as to health of employees, reporting of communicable disease in families of any persons concerned in the handling of milk supplies, regulations as to delivery of milk to infected families, purity of dairy water supplies, and finally, most important, sterilization of milk utensils and apparatus and pasteurization of all milk with the possible exception of the very highest grade. (For application of the tuberculin text, see preceding discussion of the subject.)

Regulations covering in detail the above points should be adopted by local authorities, such regulations being based upon the recommendations of the Commission on Milk Standards described below. Funds should be provided

for sufficient inspection and laboratory work to enforce the standards adopted; in the larger towns a special milk inspector, who may perhaps also act as analyst, if his inspection duties permit, should be appointed.

MILK STANDARDS

The standards adopted by local health authorities in their regulation of milk supplies should conform as closely as practicable to those which have been formulated by the *Commission on Milk Standards* appointed by the New York Milk Committee. This commission consists of seventeen experts brought together for the purpose of clearing up the confusion due to the multifarious requirements which have been promulgated by the various health authorities of the country, a purpose which has been accomplished by the formulation of definite regulations for adoption by communities of all sizes. The Commission is therefore truly a national, though unofficial, body and its decisions are to be respected accordingly. The requirements formulated by it have been approved by the International Milk Dealer's Association (of the United States and Canada), the American Public Health Association and other bodies. These requirements can only be made effective, however, through incorporation into the local ordinances of each community, an aim for which the New York Milk Committee is conducting a campaign.

The most salient of the Commission's recommendations refer to the importance of pasteurization and to the establishment of definite market grades of milk, to be produced under specified conditions and to be labeled according to grade. Other recommendations deal with standards for bacteria and for total solids and fats, with the method of pasteurization, with the details of production and handling, and with the regulation of cream supplies, covering succinctly all the chief points of the milk problem.

Since the reports of the Commission are readily available and may be altered in detail from year to year, we shall here give only the chief recommendations. The entire report should, however, be considered in detail by all local health officers.[1]

Classification of Milks. — The most important feature of the report of the Commission is the recommendation that all market milks be classified on a sanitary basis, to be graded by the health authorities by ordinance, inspection and analysis and to be so marked in the trade.[2]

There is no escape from the conclusion that milk must be graded and sold on grade, just as wheat, corn, cotton, beef and other products are graded. The milk merchant must judge of the food value and also of the sanitary character of the commodity in which he deals. The high-grade product must get a better price than at present. The low-grade product must bring less. In separating milk into grades and classes the commission has endeavored to make its classification as simple as possible and at the same time to distinguish between milks which are essentially different in sanitary character.

In general two great classes of milk are recognized, namely, raw milk and pasteurized milk. Under these general classes there are different grades. . . .

Milk shall be divided into three grades, which shall be the same for both large and small cities and towns, and which shall be designated by the first three letters of the alphabet. The requirements shall be as follows:

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[1] Copies of the Report may be obtained from the New York Milk Committee, 105 East 22nd Street, New York City, or (at five cents per copy) from the Superintendent of Documents, Government Printing Office, Washington, D. C.

[2] A grading and labeling of milk on the same general lines as those laid down by the Commission on Milk Standards has been put in effect by the Health Department of New York City, the grades being based explicitly upon the *use* to which the milk is to be put, thus: *A*. Milk suitable for infant feeding; *B*. Milk suitable for adults to drink; and *C*. Milk for cooking and manufacturing purposes. Emphasis is placed on pasteurization, and under present regulations nearly the entire city milk supply must be pasteurized. It is expected that in the near future a number of progressive towns and cities will adopt the grading system as the only scientific and practical means of controlling milk supplies.

GRADE A

Raw Milk. — Milk of this class shall come from cows free from disease as determined by tuberculin tests and physical examinations by a qualified veterinarian, and shall be produced and handled by employees free from disease as determined by medical inspection of a qualified physician, under sanitary conditions such that the bacteria count shall not exceed 100,000 per cubic centimeter at the time of delivery to the consumer. It is recommended that dairies from which this supply is obtained shall score at least 80 on the United States Bureau of Animal Industry score card.

Pasteurized Milk. — Milk of this class shall come from cows free from disease as determined by physical examinations by a qualified veterinarian and shall be produced and handled under sanitary conditions such that the bacteria count at no time exceeds 200,000 per cubic centimeter. All milk of this class shall be pasteurized under official supervision, and the bacteria count shall not exceed 10,000 per cubic centimeter at the time of delivery to the consumer. It is recommended that dairies from which this supply is obtained should score 65 on the United States Bureau of Animal Industry score card.

The above represents only the minimum standards under which milk may be classified in grade A. The commission recognizes, however, that there are grades of milk which are produced under unusually good conditions, in especially sanitary dairies, many of which are operated under the supervision of medical associations. Such milks clearly stand at the head of this grade.

GRADE B

Milk of this class shall come from cows free from disease as determined by physical examinations, of which one each year shall be by a qualified veterinarian, and shall be produced and handled under sanitary conditions such that the bacteria count at no time exceeds 1,000,000 per cubic centimeter. All milk of this class shall be pasteurized under official supervision, and the bacteria count shall not exceed 50,000 per cubic centimeter when delivered to the consumer.

It is recommended that dairies producing grade B milk should be scored and that the health departments or the controlling departments, whatever they may be, strive to bring these scores up as rapidly as possible.

GRADE C

Milk of this class shall come from cows free from disease as determined by physical examinations and shall include all milk that is produced under conditions such that the bacteria count is in excess of 1,000,000 per cubic centimeter.

All milk of this class shall be pasteurized, or heated to a higher temperature, and shall contain less than 50,000 bacteria per cubic centimeter when delivered to the customer. It is recommended that this milk be used for cooking or manufacturing purposes only.

Whenever any large city or community finds it necessary, on account of the length of haul or other peculiar conditions, to allow the sale of grade C milk, its sale shall be surrounded by safeguards such as to insure the restriction of its use to cooking and manufacturing purposes.

The report adds:[1]

Cream should be classified in the same grades as milk, in accordance with the requirements for the grades of milk, excepting the bacterial standards, which in 20 per cent cream shall not exceed five times the bacterial standard allowed in the grade of milk.

Cream containing other percentages of fat shall be allowed a modification of this required bacterial standard in proportion to the change in fat.

As to labeling:

All milk should be labeled and marked with the grade in which it is to be sold. . . . All milk should be dated uniformly with the date of delivery to the consumer. . . . The stamping on the label of the day of the week is sufficient for dating.

. . . .

Caps and labels should state whether milk is raw or pasteurized. The latter designating the grade to which milk belongs shall be conspicuously displayed on the caps of bottles or the labels on cans.

As to licensing of dealers:

A dealer shall be required to have a permit or license to sell any grade or class of milk and to use a label for such class or grade. Such permit or license shall be revoked and the use of the label forbidden when the local health authorities shall determine that the milk is not in the class or grade designated.

[1] The Department of Health of New York City, since Nov. 1, 1913, has graded cream into two grades, A and B, each of which is further subdivided into Raw and Pasteurized. These are based upon the corresponding grades in the milk classification of that city. The bacterial standard for Grade A is 100,000 per cc., while Grade B is not to contain "an excessive number of bacteria" when delivered. Specifications are laid down relative to pasteurization, delivery and labeling. (Weekly Bull., N. Y. City Dept. of Health, Sept. 13, 1913; quoted in *Am. Jour. Pub. Health*, 1913, vol. III, no. 11, p. 1243.)

Under the head of *pasteurization* the Commission prescribes the precautions which we have already mentioned under cautions as to expert management and official supervision. The views of the Commission on the necessity for pasteurization of all grades of milk with the possible exception of the very highest have also already been set forth. The prescription that pasteurized milk "shall be cooled immediately to *50° F.* or below and kept at or below that temperature" should be noted.

An important portion of the report covers the subject of *bacterial and chemical standards*. The recommendations relating to raw and pasteurized milk are as follows:

Raw Milk. — Not more than 100,000 bacteria per cubic centimeter. Not less than 3.25 per cent milk fat. Not less than 8.5 per cent solids not fat.

Pasteurized Milk. — Not more than 1,000,000 bacteria per cubic centimeter before pasteurization, nor over 50,000 when delivered to the consumer. Standards for milk fat and solids same as above.

(For standards for raw and pasteurized cream and for skim milk see Appendix B.)

The *temperature* standard for the handling of raw milk and for milk after pasteurization is 50° F.; for milk before pasteurization 60 degrees.

The "Standard Rules for the Production, Handling and Distribution of Milk" formulated by the Commission are given in full in Appendix B, to which the reader is referred for further details.

Certified Milk. — The term "certified" can only be properly applied to milk produced under specially strict conditions laid down by a duly organized medical milk commission. Such commissions may be formed according to law in most States (the term "certified" being protected) and enter into agreement with the dairyman concerned, according to which he agrees to fulfill the requirements and the commission to certify the milk. The commission has

no connection with the commercial side of the matter but simply lends its authorization in order that a specially high grade of milk suitable for the use of infants and invalids may be produced. The organization and methods of medical milk commissions have been standardized by the American Association of Medical Milk Commissions, and no commission should be considered as certifying milk that does not conform to the standards adopted from time to time by the Association.[1] Certified milk obviously constitutes a special class in Grade A of the system just described. It forms but a very small part of the milk supply of any community.

Special Milk Supplies. — A special watch should be kept over the milk supplied to hospitals and other institutions — especially those for children — to school lunches, and the like. Usually such milk is delivered in bulk in cans by special contract and it is likely to be overlooked in examinations of the general market supplies. It should, of course, conform to the same conditions as milk on the open market, the dealer should be subject to the license requirement, any grading system should apply, etc. These remarks apply also to the milk served in restaurants, lunch rooms, cafés, hotels and the like. The milk supplied at milk stations is of course of special importance, should be of Grade A and might well be pasteurized.

The sale of milk in stores should receive special attention, through both inspection and laboratory examination, being very frequently exposed to deterioration and contamination. (See page 381.)

[1] Further information as to the organization and standards of medical commissions may be obtained from the Secretary of the Association: Dr. Otto P. Geier, 124 Garfield Place, Cincinnati, Ohio. The regulations for the production of certified milk, revised to May 1, 1912, were published in U. S. Pub. Health Rpts. for June 14, 1912.

MILK AND COMMUNICABLE DISEASE

The dangers from milk in the spread of communicable disease have already been indicated in Chapter I. Under the head of epidemiology an account was given of the many ways in which milk may become infected at the various stages in production and handling. The rules to prevent infection through milk bottles left at houses where a case exists were given under the head of isolation regulations (page 127).

Milk infection is most to be apprehended from cases of communicable disease — frequently missed (or even concealed) or carrier cases — among persons in any way connected with the handling of milk or milk utensils.[1] Even drivers, through handling bottles and other containers, are potential infecting agents. Farm water supplies as possible sources of infection will be taken up in the next chapter. Prompt report of infection among persons connected in any way with milk supplies should be required of physicians to be made (by telephone or telegraph followed by writing) to the state department of health or to the health department of the town to which the milk is sent, as well as to that in whose district it occurs. Cases in the families of such persons should also be included under this regulation on account of the danger of the employee developing an active or carrier case of the disease. Each case should be dealt with promptly and firmly on its merits, on pain of exclusion of the milk supply. If there is reason to believe that the supply is infected it should be cut off until matters have been so arranged that there is no possible connection between patient and nurse and milk supply. The patient should, if possible, be removed from premises where milk is handled; but if not, nothing short of complete and

[1] The Montclair, N. J., Board of Health has recently adopted a requirement that such persons file medical certificates of freedom from evidence of communicable disease every three months. The aim in this case is to obtain a high-grade public supply of raw milk.

positive isolation of patient and nurse (the latter to be thoroughly competent), with entirely satisfactory disinfection measures, should be permitted. Then, before resumption of business is allowed, all bottles, cans and other apparatus and utensils should be sterilized by steam or boiling under official supervision. The possibility of carriers, incipient and mild cases produced by contact with the original case must not be overlooked; in typhoid fever, known and suspected contacts concerned in the handling of the supply should be kept under more or less close observation, and cases of sickness should be isolated and the blood examined (see page 196 f.); in diphtheria, cultures should be taken for the same purpose (two consecutive negatives to be required of suspicious cases). It is obvious that searching precautions are worth while when there is question of protecting a milk supply at the source. Detailed rules cannot be laid down; each case must be dealt with on its merits and the principles involved.

All of this simply emphasizes the remarks made earlier as to the desirability of protecting milk supplies — especially the larger ones — by pasteurization. Where adequate routine pasteurization of milk is practiced, with sterilization of bottles and other containers, utensils and apparatus, and with proper mechanical handling, the chances of infection are practically eliminated. Inspections and physician's reports are not complete safeguards, and infection has been known (as in recently reported epidemics) to be possible under the best apparent conditions of cleanliness as commonly understood.

METHODS OF CONTROL

Milk regulations are enforced, on the one hand, through inspection of equipments and methods, and, on the other, through laboratory tests, bacteriological and chemical, of the product. The two forms of supervision supplement each other, the laboratory methods pointing out deficien-

cies which inspection cannot practically detect, while inspection searches out and applies the corresponding remedies.

I. CONTROL BY INSPECTION.

Milk supplies require *inspection at the following points:*

1. At the dairy farm.
2. At the bottling establishment.
3. In transportation, whether by wagon in the country, by railroad, by wagon or otherwise in the city.
4. While on sale, from wagons, stores, etc.

To this schedule we may add the care of milk in the home, the final and important matter but necessarily left to the consumer.

Such inspections include not only milk and its products but also the empty containers on their way back and forth.

The proper inspection of the various processes of milk production and handling requires a knowledge of trade methods as well as of sanitary requirements, an understanding of the point of view of the dairyman and dealer as well as that of the health official and sanitarian. The efficient milk inspector should be an adviser and instructor of the dairyman as well as a monitor.

Even in small towns milk inspection should constitute a special and separate branch of the work of the department of health presided over by a milk inspector. Milk inspection involves so many details and demands so intimate a familiarity with the details of the milk industry that it cannot be adequately carried on by halfway methods. In the small town the milk inspector may make all the inspections necessary [1] — farms, bottling establishments, stores, etc. — and frequently collect samples and perform laboratory analyses. Where a town is unable to support a whole-time expert inspector and a milk laboratory of its own, the solution may be to coöperate with a neighboring

[1] Cf., however, remarks on state inspection, p. 395.

town or towns in the maintenance of a *joint inspection* or at least of a joint laboratory; thus efficient work which would otherwise be impossible may be carried on without great expenditure. The possibilities in *state* inspection will be discussed in a later paragraph.

Milk inspectors should preferably be graduates of agricultural or dairying schools. This, however, is not essential, and an intelligent man interested in the work will soon pick up the practical points and with the aid of the score-card (which will be described presently) will be able to perform accurate and effective inspections. Knowledge of veterinary medicine is not essential, for the board of health may (the best plan) appoint its own veterinarian, or, if not able to do this, require the written certificates of reputable veterinarians as to the health of herds (see requirements of Commission on Milk Standards). For laboratory work, on the other hand, adequate technical training is necessary.

THE SCORE-CARD SYSTEM is now applied very generally by efficient health authorities to the inspection of dairy farms, bottling establishments, creameries and stores handling milk in bulk. There is no question that this is the best means of making thorough inspections, both for the expert and for the inexperienced inspector. In discussing its advantages to the health department, the Department of Agriculture experts, whose cards are used as standards, remark:

> The score-card system is of particular value to the inspector in pointing out conditions, thus making it impossible to overlook any point of importance. All these items are kept in a permanent record by this system and comparisons can readily be made. . . .
>
> Where the score-card system is in use there is frequently more or less competition for high scores. No dairyman wants the name of being the poorest. This competition makes it easier for the inspector to improve conditions, as his suggestions are readily heeded.[1]

[1] Lane and Whittaker, "The Score-card System of Dairy Inspection," U. S. Dept. of Agric., Bureau of Animal Industry Circular 139, 1909. Cards for scoring dairy farms, city milk plants and stores

From the standpoint of the producer the system has marked advantages. He can feel that he has received an accurate and impartial score, for with everything written down in black and white the opportunities for error and favoritism are small. If the inspector has tact and talks over with the dairyman the various ratings on the card and the reason for the score he makes, the dairyman becomes interested and is helped by means of the card. If the inspector has sufficient skill to make not only a reasonably accurate score but also some suggestions, he becomes a friend and helper of the dairyman and his visits are looked forward to with satisfaction. The score-card system is simple and easily understood. In some places the health authorities have made too many and too complex regulations. They have studied what is necessary in the production of sanitary milk and then have embodied these essentials in a dairy law. If such a code were literally obeyed it would result in perfect milk, which is impossible, and the health authorities know that the law will not and cannot be enforced. The dairyman, however, looks at the formidable code of fifteen to twenty pages with feelings of perplexity and irritation, knowing that he cannot comply with its requirements. Rating a dairy according to its merits does away with this irritation, and as the dairyman makes improvements he has the satisfaction of seeing his score increase. The score card protects the dairyman from the faddist who can see nothing but the tuberculin test, a cement floor or white milking suits.[1]

The score-card system makes it a simple matter to establish certain inspection standards for different grades of milk (cf. Appendix B, Standard Rules of the Commission on Milk Standards).

There is abundant proof that the score-card system brings immediate and permanent results wherever it is put in practice. Magruder, in a paper which we have already quoted, cites the example of Richmond, Va.:

handling bulk milk have been adopted by the Department of Agriculture and are recommended for adoption by local health authorities. For copies of the cards (which cannot conveniently be reproduced here), detailed directions, and advice as to their use, apply to the Bureau of Animal Industry, Washington, D. C.

[1] Whittaker, "The Score-card System of Dairy Inspection from the National Standpoint," *Jour. Am. Pub. Health Assn.*, 1911, vol. I, no. 9, p. 647.

The experience of Richmond, Va., with inspection has been most gratifying. Inspection began in May, 1907. The average rating of the farmers was 41.5 out of a possible 100. But 15 per cent of the dairies scored above 60. In December, 1911, not one was rated below 70. Of all supplying Richmond, 67.4 were rated between 80 and 90; 5.5 per cent were rated above 90. In his report for 1911 the Health Officer says: "The inspector has been enabled to give sound practical advice to our dairymen, thereby assisting them in many ways. . . . Practically all our dairymen have come to regard him as a real friend and helper."

Much improvement has also been obtained at Washington, D. C., where the score-card was first used, under Health Officer Woodward, and many other places.

There is, however, a caution which should be emphasized in connection with the use of scores for administrative purposes. It must be remembered that a score represents simply the general condition and for this reason does not always indicate the importance of certain particulars which, if deficient, may assume a greater importance than would be indicated by the regular deduction from the score. This, it is true, is partly provided in the use of the card, by making special arbitrary deductions from the score; nevertheless certain *specific minimum requirements* (such, for example, as to temperature) *as well as a minimum total score* should be laid down and enforced by ordinance. For these the Rules already referred to (Appendix B) may be used as the basis. In fact, with such minimum requirements the use of the score-card might possibly be done away with, but for the present, in most places, a combination of the two methods of regulation is perhaps most practicable, — the one covering the general condition, the other particular points.

1. **Dairy Farms.** — The Department of Agriculture *score-card* [1] may be taken as an illustration, in connection with the Rules of the Commission on Milk Standards (Appendix B) of dairy farm inspection. Minimum requirements should, as above suggested, be adopted in

[1] For copies of card, detailed directions and advice apply to U. S. Bureau of Animal Industry, Rept. of Agriculture, Washington, D. C.

accordance with the Rules. Special attention should be paid to the important and essential points, such as cleanliness of cows, utensils and methods, and cooling. Utensils and containers should be kept scrupulously clean and should be sterilized by scalding if not with live steam. The use of small-mouth milking pails is an important point; it has been shown that through their use 90 per cent of the bacteria getting into milk at the time of milking can be eliminated (experiments by Stocking). Hooded pails cost little more than ordinary ones and dairymen readily become accustomed to their use. A frequent trouble is the use of cheap utensils, which deteriorate and accumulate dirt and decaying milk solids in cracks and holes.

Farm water supplies should be carefully looked after, for it is frequently not at all certain that milk utensils are properly sterilized, and they may of course be contaminated by the washing water. It is possible also that cows may, after wading in polluted streams, infect milk mechanically through the water remaining on their udders and other parts.

In making recommendations to the dairyman infinitely more can be accomplished by frequent visits, taking up a few important points with him each time, and when these have been accomplished passing on to the less essential, than by sweeping visits months apart in which so many recommendations are made that confusion and discouragement are created. In point of fact, annual, or even semiannual, visits accomplish practically nothing; *frequent reinspections* are absolutely necessary, the more frequent according to the requirements of the case. This applies to all kinds of milk inspections. A number of departments make their regular dairy inspections once a month. At the same time, where objectionable conditions are suspected, it may be desirable to inspect at irregular and unexpected times. When a farm is revisited frequently the score can readily be revised (for certain of the items will remain un-

changed from time to time), or supplementary reports can be made on special conditions.

It is recommended that the inspection of dairies be systematized, so as to insure adequate inspection and to facilitate laying out routes. A *plan* has been suggested by Lane and Whittaker (Circular 139, Bureau of Animal Industry) which is readily applicable to places of all sizes. Its essentials are: a large map on which are indicated the locations of dairies by means of tacks, each having a number on its head representing the dairyman's permit number (the tacks may be of different colors to distinguish between different grades), and an index list in connection with the map, showing each dairyman's name, permit number and the latest scores for each. Where the milk from two or more dairies is collected by one dealer these should be grouped together and their average given in the list. Map and list may be placed in the health office so that both dairymen and public may readily consult them. This tends to produce improvement by dairymen and enlightenment of citizens.

For remarks on number of inspectors required, etc., see later under Organization.

2. **Shipping and Bottling Establishments.** — Milk after production is usually either bottled on the farm and sold by the producer, or it is collected from one or more farms by a dealer who bottles it either in the country or in the city. Some milk, of course, is not bottled at all, but is peddled from cans either from wagon or from store. The tendency is more and more toward the handling of milk by large dealers who collect from numbers of separate dairies on a wholesale scale. Plants or depots where milk is collected in the country districts, frequently called "creameries," are often many miles away, so that railroad transportation to the town or city becomes necessary. Whether milk is collected at a point in the country or city, whether it is bottled in the country or city, whether in a plant handling hundreds of quarts a day or in a milk house

handling only a few dozen, the principles of inspection are the same, and are in fact precisely those which govern dairy inspection: Milk should be exposed to the air as little as possible, and the air should be pure; it should not be handled in unclean utensils or apparatus, and it should always be kept cool. The same considerations also apply to pasteurizing plants, with the additional attention required to the process itself.

The *score-card*[1] of the Department of Agriculture for "sanitary inspection of city milk plants" may readily be applied or adapted to any establishment handling milk, large or small, in the country as well as in the city. When milk is bottled in a milk house on a dairy farm, the same should be considered as a bottling establishment as well as a milk house and the corresponding regulations should apply to it. The score-card favors plants which have separate rooms for the various processes, full sets of mechanical devices (for bottling, etc.), and other conveniencies; such equipment makes for sanitation as well as convenience. At the same time it is possible for the smaller establishments, by installing proper appliances and operating according to requirements, to come up to a proper standard.

As with dairy farms it is very desirable to establish for milk receiving and bottling plants certain *minimum requirements*. Some such requirements have been framed by the Commission on Milk Standards (see Appendix B). The following, in more detail, are also suggestive. Such minimum requirements should of course be thoroughly reasonable and enforceable — virtues not always found in milk ordinances — and should apply equally to large and to small establishments. It is perfectly feasible to maintain such requirements in combination with the scoring system, making a certain minimum score one of the requirements. Thus both general and specific conditions will be covered.

[1] For copies of card, detailed directions and advice apply to the Bureau of Animal Industry, Dept. of Agriculture, Washington, D. C.

Be it enacted by the Board of Health of the [town, city, village] of ——, as follows:

The term "milk-bottling establishment" or "establishment," as hereinafter used, shall be held to include any and every building, or part of a building, wherever located, in which milk is bottled for sale or distribution in the [town, city, village] of ——. The term "bottling room" shall be held to apply to any room, or part of a building, in which milk is exposed or bottled, and the term "washing room" to any room, or part of a building, in which any containers, apparatus or utensils, used in the handling of milk, are cleansed or otherwise treated. The following rules shall apply to all such milk-bottling establishments; and no milk which has been bottled, handled or stored in non-compliance with or violation of any of said rules shall be sold, held or offered for sale, or delivered in the [town, city, village] of ——, under a penalty of twenty-five dollars for each and every offense.

1. No such establishment shall be located within 100 feet of any hog pen, manure pile, privy vault or other source of contamination.

2. Water used for washing bottles and utensils shall be obtained from a source subject to approval by this Board.

3. Every privy vault located on any premises where milk is bottled shall be so constructed that the contents shall be inacessible to flies, and every such privy vault shall be kept at all times in a sanitary condition.

4. Bottling and washing rooms shall conform to the following requirements:

(*a*) Floors to be water-tight, constructed of cement, concrete or other non-absorbent material, and properly drained to a point or points at which drainage is disposed of.

(*b*) Walls and ceilings to be smooth and kept well painted or lime-washed.

(*c*) Adequate natural or artificial light to be provided.

(*d*) Adequate ventilation to be provided.

(*e*) Rooms to be thoroughly screened against flies from April first to November first of each year.

5. Drainage shall not be permitted to flow into or upon the ground underneath the establishment or within 100 feet of the same. If drainage is collected in a cesspool or other receptacle, the same shall be water-tight and shall be kept in a sanitary condition.

6. Non-employees shall be excluded at all times from bottling and washing rooms.

7. Milk on reaching the establishment shall be immediately cooled to a temperature not exceeding 50° F. (if such cooling has not already taken place), and shall be thereafter maintained at such a temperature. Cooling tanks shall be constructed of smooth, water-tight, non-

absorbent material, and the water in such tanks shall be changed at least once a day during the months of May, June, July, August and September, and at least twice a week during the remainder of the year.

8. All bottles and other containers, apparatus and utensils, used in handling milk, shall, after use and before being re-filled or re-used, be thoroughly cleansed and sterilized.

9. Adequate lavatory facilities for employees shall be provided, separate and distinct from apparatus used for handling milk or treating milk utensils. All employees engaged in bottling and washing rooms shall, before beginning work and after visiting the toilet, wash their hands thoroughly with clean water and soap.

10. No bottling or washing room shall be used as a living or sleeping room or be directly connected with such room or be used for any other purpose other than the storage or handling of milk and milk utensils.

11. No person affected with typhoid fever, dysentery, scarlet fever, diphtheria, tuberculosis or any other communicable disease, which may be declared by the Board to be included in this regulation, shall be employed in any milk-bottling establishment; nor shall any member of the family or household of any such person be so employed, unless by permission of this Board.

12. All milk utensils and apparatus shall be of such construction as to be readily cleansed and shall be kept in good repair and free from rust.

13. Bottle-caps shall be kept in a clean, dust-proof container.

14. Bottling and washing rooms and all parts thereof shall be kept clean and free from offensive odor. Dirt, dust, rubbish, clothing, all articles not used in the handling of milk and domestic animals shall not be permitted in such rooms.

15. All employees in bottling and washing rooms shall keep themselves and clothing in a clean condition. Clean aprons or suits used for no other purpose shall be worn by such employees while in the performance of their duties.

16. No spitting or smoking shall be permitted in bottling and washing rooms.

17. A copy of the above rules, furnished by the Board of Health, shall be posted in a conspicuous place in each milk-bottling establishment.

18. No milk shall be bottled except in an establishment in which all of the foregoing regulations are complied with, and at no time and in no place shall milk be exposed to contamination by dust, dirt, flies, communicable disease or any other act or thing injurious to health.[1]

[1] Ordinance adopted in Orange, N. J., 1913.

It would be well to require that such conditions be fulfilled before a license is issued to the dealer, reserving the right to revoke the license in case there is failure to live up to the ordinance. A form of inspection card based on such requirements could readily be made up, differing from a score-card in taking account simply of conditions all of which would be *required.*

The requirement (8) of *sterilization* practically means the installation of a steam boiler and the necessary apparatus in every establishment — a steam chamber, and jets for the treatment of cans, "fillers," etc. There are a number of installations on the market for the purpose. A simple apparatus is not an excessive requirement for any bottling establishment which pretends to enter seriously into the important business of handling milk, and this is the only kind which should be permitted to operate. The effects of the best apparatus, however, may be lost through mismanagement, and inspection should insure that routine sterilization is complete, also that there is no contamination of bottles or utensils after sterilization and before use.

The inspector of establishments handling milk should note whether it is allowed to remain in uncovered tanks, vats, bottling machines, cans or bottles any longer than is absolutely necessary before placing in storage; whether coolers, receiving tanks and the like are protected by cheese-cloth or other covers when not located in specially constructed sanitary rooms; and whether milk is passed through piping that cannot be taken apart and properly cleaned.

The health of employees is a most important consideration which the inspector should always bear in mind, being on the lookout for positive or suspected cases of communicable disease.

3. **Milk in Transit.** — The inspection of milk in transit at various stages is an important consideration frequently neglected. In country districts it may be transported in an

open farm wagon in warm weather with little or no protection from the summer warmth; on the railroads it frequently is carried in cars which have no refrigeration facilities; in the town, on its way from railroad station to bottling plant it may suffer a further rise in temperature. At all stages it may be left standing on station platforms, perhaps in hot sun, and other places where it is insufficiently protected from warmth and contamination by meddlers.

Inspection of transit conditions relates chiefly to temperature and to seeing that containers are not sent back without washing. The law should prescribe a temperature standard for the different grades of milk, 60° F. being the maximum allowed for any grade, with 50 degrees as the maximum for milk after pasteurization (see Rules, Appendix B), and temperatures should frequently be taken. The jacketing of cans is by no means always sufficient to keep down temperature, and refrigeration en route may sometimes have to be resorted to, especially when the initial temperature was not very low.

As to the condition of empty containers, a provision should be adopted to the effect that no such container may be placed in transportation without proper washing. This provision does not of course necessarily apply to milk bottles for it is not desirable to require householders to cleanse bottles, and if they did so the temptation on the part of the milk dealer to re-fill the same without sterilization would be increased. The proper place for the cleansing of cans, milk pails, etc., is the receiving or bottling plant, where there are adequate washing facilities and where sterilization can also be performed. It would be well if country creameries would adopt a rule requiring farmers to bring pails and other utensils, as well as cans, to the creamery to be washed and sterilized; this would be an assurance that these operations are properly performed and a protection against the possible contamination of farm water supplies.

4. **Milk on Sale.** — Supervision here applies both to wagons and to stores and booths.

In regard to *wagons* the same principles apply as to milk in transportation. Plenty of ice on delivery wagons in the warmer months should be the rule. Some milkmen make a practice of filling bottles in their wagons, frequently using for this purpose returned bottles which have not been properly washed and sterilized; this should of course be strictly forbidden, as well as the practice of transferring milk from can to can, in delivering or otherwise, on the street. In the same way the peddling of "loose" or "dip" milk from wagons is objectionable unless carried on in a closed wagon with special care.

The use of milk tickets which are used more than once should be forbidden.

In regard to *stores* the question is much more difficult. In many cases milk is sold in stores as a minor side-line, or merely as an accommodation to customers who come primarily to buy groceries, produce, etc. In such cases proper care is not likely to be taken of it and it is subject to various contaminations. At the same time the sale of milk in stores, particularly "loose" or "dip" milk in cans, is an important source of supply for poor people who buy in small quantities and must therefore be regulated rather than forbidden. Such is the policy which has been adopted by active health departments. As an indication of the points to be looked to in such stores the *score-card* [1] of the Department of Agriculture may be consulted.

Of course where bottled milk is sold in stores the only requirement to be applied is proper refrigeration, with the assurance that bottles are not opened and sold in "split" quantities.

Here again, as in the inspection of dairy farms and receiving and bottling establishments, reliance should not be

[1] For copies of card, detailed directions and advice apply to the Bureau of Animal Industry, Dept. of Agriculture, Washington, D. C.

placed upon the score alone, but there should be certain *minimum requirements*, the character of which is indicated by the following regulations adopted by the Health Department of New York City in 1913.

REGULATIONS FOR THE SALE OF DIPPED MILK AND CREAM IN STORES

1. Milk or cream shall not be stored, handled or sold in any stable, or in any room used for cooking or domestic purposes, or in any room which communicates directly with any such stable or room, or in any room in which there is a water closet apartment or with which a water closet apartment communicates, unless such apartment be enclosed by a vestibule, and both apartment and vestibule be properly ventilated to the external air.

2. The term " domestic purposes " shall be held to apply to rooms used for sleeping purposes or for cooking purposes other than the preparation of the midday meal.

3. Milk or cream shall not be handled or sold in any room which is unduly crowded.

4. Milk or cream shall not be dipped from cans stored in a room in which butter or cheese is manufactured.

5. Milk or cream may be stored in a cooling or refrigerating room, or ice chest, the construction of which has been approved by the department.

6. No milk or cream shall be dipped from cans stored in a milk booth.

7. Milk shall be kept at a temperature of 50° F. or below at all times.

Equipment

1. Rooms in which milk or cream is handled or sold shall be well lighted.

2. The floors, walls and ceilings shall be smooth, and must be kept clean and sanitary.

3. All windows and doors shall be properly screened.

4. An adequate supply of hot water shall be provided for the washing of utensils.

5. A sufficient number of properly constructed ice tubs, or other adequate refrigerating facilities, for cans of milk or cream shall be provided.

6. All utensils used for dipped milk or cream shall be of the seamless sanitary type, heavily tinned.

Methods

1. No milk or cream shall be dipped from cans stored in any room in which rubbish or dirty material is allowed to accumulate, or in which there are offensive odors.

2. All cans or other receptacles used for milk or cream shall be cleaned thoroughly upon emptying.

3. The cans from which milk or cream is dipped shall be packed in ice, and shall be kept covered at all times, except when the milk or cream is being actually dipped therefrom.

4. After each day's use all utensils shall be thoroughly cleaned with hot water and soda, and then with boiling water.

5. All utensils used for dipped milk or cream shall be kept clean.

6. The ice tubs in which milk or cream is stored shall be painted inside and outside, and shall be kept clean at all times.

7. A separate dipper shall be provided for each can from which the supply is being served, and such dipper shall remain in the can between dippings until all the milk in the can has been disposed of.

8. All goods sold in milk stores must be either in unbroken packages, or must be so placed, protected and handled that no dust or odors therefrom can injuriously affect the milk.

9. Dry sweeping and dusting in rooms in which milk or cream is dispensed is prohibited.

10. The tags on cans of milk or cream must be kept on file in the store for at least two months for inspection by the Department of Health.

11. The attendants shall wear clean, washable outer clothing.

12. Only such persons shall be employed as are free from infectious diseases which may be transmitted in the handling of milk.[1]

A permit system should apply to stores, which should be required to post their permits in a conspicuous place.

The Commission on Milk Standards prescribes that all stores in which milk is handled be provided with a suitable room or compartment in which milk shall be kept, said compartment to be clean and so arranged that the milk will not be liable to contamination.[2] The maximum temperature allowable for such milk is set by the Commission as 50° F.

[1] *Weekly Bull. N. Y. City Dept. of Health*, Aug. 30, 1913.

[2] Passaic, N. J., requires that each store have a special milk booth constructed according to plans furnished by the health department. Note, however, that in the sixth regulation above, ordinary booths are disapproved.

The care of milk in the home is a subject for publicity. Some health departments issue circulars urging that milk be kept clean, cold and covered, as otherwise a good deal of the benefit of inspection, pasteurization and other public precautions is lost. Infant hygiene nurses should give instruction on this point. (See page 313.)

II. LABORATORY CONTROL

Laboratory examinations of milk are of no less importance than inspection; in fact they are in a sense even more important, for by them alone can the health authorities learn the quality of the milks supplied and ascertain where deficiencies lie. Without laboratory facilities efforts for improving the hygienic character of milk supplies are made in the dark. Hence every department of health should be provided with a laboratory with an analyst who is capable of carrying on the necessary routine bacteriological examinations. Such a laboratory is not expensive to equip and maintain (see Appendix D), and in many cases the milk inspector with laboratory training will be able to make his own examinations. Small communities which cannot afford to maintain separate laboratories may join with others in the maintenance of a common laboratory. Money spent for laboratory work will be repaid many times in benefit to the public health.

Laboratory work may be mentioned chiefly under the following heads:

1. Collection of samples (including temperature taking).
2. Bacteria tests (bacteria counts).
3. Chemical tests.
4. Tests for visible dirt (sediment).
5. Tests for adulteration and preservatives.

In addition, if facilities allow, examinations may be made for kinds of bacteria, pus cells, etc.

1. Collection of Samples. — "Samples of milk should be taken at regular intervals for analysis. These should be

collected largely from retail delivery wagons, so that they will represent the product received by consumers. Where the milk is bottled, sampling is a simple matter, as one bottle will suffice for a sample. Where milk is dipped from cans or drawn from faucets, sampling is not so easy. However, if the inspector puts himself in the position of a consumer, taking the product sold to him for a sample, this will represent what the dealer is actually selling. . . . Persons collecting samples should be familiar with the manner of taking evidence in court and should be able to prove the identity of the sample delivered to the analyst. It should not pass out of sight of the inspector until personally delivered to the man in the laboratory who is to examine it, unless it is under seal and properly marked for identification. When the inspector takes several samples on a single trip, each sample should be marked as soon as taken, so that no question can be successfully raised as to the possible mixing up of the samples."[1] State laws very frequently prescribe the procedure for taking legal samples (providing, for example, for the return of a sealed portion of the sample to the dealer) which should be exactly followed where prosecution is planned. In such cases a witness should accompany the inspector. For ordinary collection of samples, however, ordinary care should suffice, without cumbersome formality.

For the collection of bacteriological samples of loose milk sterilized four-ounce bottles with wide mouths and ground-in stoppers will be found convenient; care should be taken to protect the mouths of these, before and after filling, by means of a tin-foil cap. Milk may be dipped into these by the dealer just as it would be given to an ordinary consumer. Other methods of collection are given in the text-books on milk examination.[2]

[1] Lane and Whittaker, Bureau of Animal Industry, Circular 139.

[2] Cf. Tonney, "An Inexpensive Outfit for the Collection of Bacterial Milk Samples," *Am. Jour. Pub. Health*, 1912, vol. II, no. 5, p. 364.

Where the inspector takes the sample himself he should be careful to mix the milk thoroughly and to the satisfaction of the dealer, so as to get a representative sample. Pains must be taken that all articles used in the collection of milk samples be thoroughly sterilized and kept so until use. If temperature is taken, an accurate and clean thermometer should be used and this act should be performed after the taking of the bacteriological sample.

In addition to the samples from *wagons*, collections should be made of *store* milk, which will usually be found much in need of bacteriological control. Samples may also be taken from time to time of milk before bottling and in transit, if it is desired to locate special difficulties.

Milk samples between collection and examination must, it scarcely needs be said, be kept strictly iced.

Care in manipulation must be exercised throughout, and the collector of milk samples should have a knowledge of the principles of, and necessity for, bacteriological cleanliness; otherwise contaminations which would vitiate the final results may occur.

2. Bacteria Tests. — The principal bacteriological test is that for the *total count*, expressed as "bacteria per cubic centimeter." This should be obtained according to the standard methods of the Laboratory Section of the American Public Health Association.[1]

The importance of bacteria counts, especially in the grading of milks, has been indicated in the foregoing pages. The Commission on Milk Standards of the N. Y. Milk Committee concludes that "among present available routine laboratory methods for determining the sanitary quality

[1] For reference see Appendix D. The Commission on Milk Standards recommends the following amendments: "*A*. That the culture medium used for testing milk be identical in its composition and reaction with the culture medium used for the testing of water provided in the standard methods of water analyses of the American Public Health Association. *B*. That incubation of plate cultures be made at 37° C. for 48 hours." (2d Rpt., 1913.)

of milk the bacteria count occupies first place." In the majority of instances the bacteria indicate dirt, or lack of refrigeration, or age. (The total count has no direct reference to the specific bacteria of disease, see below.) In the words of the Commission, "milk with a high bacteria count is not necessarily harmful, but when used as a food, particularly for children, is a hazard too great to be warranted. Milk with a high bacteria count, therefore, should be condemned. Milks with small numbers of bacteria are presumed to be wholesome, unless there is reasonable ground for suspecting that they have been exposed to contagion."

Various *standards*, ranging from 100,000 to 500,000 bacteria per cubic centimeter, have been set by various communities for their market milk. Those recommended by the Commission on Milk Standards should be adopted as representing the most advanced practice. Naturally, however, it will be easier for communities drawing their supplies from nearby to obtain low bacteria counts than those which use milk brought from greater distances in longer periods of time.

There is a diversity of opinion as to the best *method of valuing* a series of bacteria counts. The average of the counts for a certain supply would indicate the average number of bacteria received by the consumer and hence the general effect on health, though not necessarily showing individual high counts. The Commission (1913) gives the following rule:

> That the grade into which a milk falls shall be determined bacteriologically by at least five consecutive bacteria counts taken over a period of not less than one week nor more than one month, and at least 80 per cent (four out of five) must fall below the limit set for the grade for which the classification is desired.

A similar consideration should apply to the *publication* of laboratory results, so that the tests will be sufficiently numerous to be truly indicative; single scattered tests vary and may be misleading unless a sufficient number is taken to produce a reliable average.

In laboratories where facilities warrant, additional tests may be made for kinds of bacteria (e.g., colon and other intestinal types, streptococci, etc.). It is a rare thing, however, for a laboratory to undertake the examination of milk for the detection of the bacteria of disease, because of the extreme difficulties in detecting them. Nor, in many cases, would there be any practical advantage even if such tests were successful, for the fact of infection can be established most readily by epidemiological evidence. As for protection from such infection, the most effective method is by medical, veterinary and sanitary inspection, and by pasteurization.

3. **Chemical Tests.** — Chemical tests and the others which will be mentioned take a secondary place from the sanitary standpoint. Chemical tests are, however, necessary as an indication of the food value of the product sold. Those commonly made are for milk fats and other solids. The Babcock method is the simplest for determining the percentage of *fats*. If at the same time lactometer and temperature readings are taken the *total solids* may readily be gauged with a fair degree of accuracy by means of the formulæ and tables given in the laboratory text-books. This may suffice for routine procedure, but more exact methods (which, however, require more time) — useful, for example, in preparing for prosecution — are described in the text-books and may be followed where laboratory facilities permit. The chemical results may be expressed as "fats" and "total solids," or as "fats" and "solids not fat." The standards adopted for whole milk should be those of the Commission on Milk Standards: 3.25 per cent fat and 8.5 per cent solids not fat.

In the interpretation of percentages it should be borne in mind that falling below the standard does not necessarily indicate fraud through skimming or added water, but may be due to the use of cattle giving a thin milk. This is especially true of certain breeds. This does not, however,

constitute an excuse for the dairyman, who should obtain his supply from herds so composed that they give the required food values. Adulteration of milk through watering and skimming will be mentioned below.

4. **Tests for Visible Dirt (Sediment).** — These have come into considerable use, principally because they demonstrate visibly the gross forms of dirt in milk in a manner which is convincing to the dairyman and the public. Thus they are supplementary to the bacteria tests, which of course gauge to a far finer degree the effects of dirt. Dirt in milk may be detected by examining the bottom of the bottle after the sample has stood for an hour. It is determined quantitatively by methods involving centrifugalizing or straining, which are described in recent text-books and papers. A recent paper mentions a dozen or more such methods.[1] Several dirt testers are now offered on the market. A quart or pint of the milk is usually strained through a cotton disk, the visible dirt being retained upon the latter; the disk is then dried and may be cut in two, one-half being given to the dealer and the other kept on file. A series of grades according to the amount of sediment may be established. The sediment consists of undissolved cow manure, dust, hairs and other foreign matter, which fact, stated to the dairyman, assists in the improvement of dairy methods, especially if the tests are made a matter for public exhibition. It should be especially impressed that this dirt should be kept out originally rather than be strained out after contamination has taken place. Comparative tests are made of the supplies of their individual producers by various large creameries, as well as by health authorities, and the results posted, with good results. It must be borne in mind, however, that while this is a useful, it is strictly a subsidiary, method of laboratory control.

[1] Schroeder, "Dirt Sediment Testing — A Factor in Obtaining Clean Milk," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 1, p. 50. Cf. Tonney, *ibid.*, 1912, vol. II, no. 4, p. 280, and Schroeder, *ibid.*, 1912, vol. II, no. 5, p. 360.

5. Tests for Adulteration and Preservatives. — Where tests of this class have been regularly carried on it is found that the addition of adulterant or preservative seldom occurs. Such tests are readily performed, and the heavy penalties which in the past have been applied have resulted in effectually discouraging the tendencies to this class of frauds. The adulteration of milk through watering or skimming still, however, occurs not infrequently, especially where few or no tests are made by the health authorities.

Where milk is adulterated through *watering* or *skimming* the penalty should be more severe than where it is simply below the standard for solids. In order, however, to prove such adulteration it is necessary to resort to refractometer tests, and recourse should therefore be had to a laboratory where such can be made. Examinations of this class, in cases where prosecution is to be undertaken, require strict legal procedure and adequate laboratory technique. Hence they are best usually assigned to state food and drug inspection service.

Among possible preservatives of milk and cream formalin is the chief.

The addition of formalin, as well as most other forms of adulteration and preservation, can readily be detected by simple tests. When preservative is used it may frequently be suspected from the abnormally low bacteria count which results.

Cream is subject to addition of thickeners (e.g., gelatin) and preservatives, for which tests may be made in suspected cases.

In general, it seems necessary for local authorities to make tests for adulteration and addition of preservative, not as a routine measure, but only in those cases rendered suspect by the results of the regular bacteriological and chemical tests.

For methods see text-book references at close of this section. (Cf. Bull. 100, U. S. Bureau of Chemistry, on simple tests.)

The subject of *microscopic examination* of milk and the determination of pus and bacteria by sedimentation methods is one in which general agreement as to values and methods has not been reached. It is now under consideration by a special subcommittee of the Commission on Milk Standards and will be reported upon later.

Frequency of Tests. — As a general rule, every supply should be subjected to bacteriological and chemical examination at least once a month. Low-grade and suspected supplies should be examined more frequently, and a policy of following up such supplies will produce much better results than an undiscriminating routine. During warm weather the frequency of examination should be increased. If laboratory facilities are limited, special attention should be paid to making frequent bacteriological tests, even if the number of chemical tests does not keep pace; for the former are of greater significance to the public health.

MILK PRODUCTS

After milk, attention should be paid to cream and ice cream supplies. The standards adopted for *cream* should be those of the Commission on Milk Standards, which provide that "cream should be classified in the same grades as milk, in accordance with the requirements for the grades of milk, excepting the bacterial standards which in 20 per cent cream shall not exceed five times the bacterial standard allowed in the grade of milk" (modification of bacterial standard according to percentage of fat when this percentage is different from 20), while standard cream is to contain "not less than 18 per cent of milk fat" and to be "free from all constituents foreign to normal milk."

The regulation of *ice cream* requires some special remark. Ice cream is frequently made from poor grades of milk and cream and under the most unsanitary conditions, often in dark, dirty basements. Yet the product is consumed to a large extent by children and invalids, the most sus-

ceptible part of the population. Hence it requires careful sanitary regulation, consisting both in inspection (for which a score-card similar to that for milk plants may be used) and analyses of the raw materials and of the finished product. In the inspection special attention should be paid to the care of utensils, the prevalence of flies and the objectionable use of the fingers in tasting and handling the product; for the latter purposes proper spoons and other utensils are to be insisted upon. In New Jersey a special score-card has been adopted and inspections are made by the State Department of Health, the establishments being required to come up to certain requirements before a license is issued. This gives the advantage of uniform and expert inspections, but elsewhere it may be necessary for many communities to look after their own inspections.

In Montclair, N. J., where a special effort has been made to improve the ice cream supplies a bacterial limit of "500,000 bacteria per cubic centimeter, measurement to be made immediately after the ice cream has been reduced to a fluid condition," has been adopted. The pasteurization of milk and cream used in making ice cream may be permitted under proper conditions.

The percentage of fat in ice cream, though secondary to cleanly conditions of manufacture and the purity of the product, is important as indicating the food value. Analyses made in Montclair showed that this figure ranged from 3.0 to 17.0 per cent. Standards should be established or at least the results should be published and the dealers required to guarantee a certain percentage by statement on the label, especially as gelatin thickener is frequently used.

Health departments should publish data and remarks under all of the above heads, relative to the local ice cream supplies.[1]

[1] See Rpt. of Bd. of Health of Montclair, N. J., for 1913; and Bahlman, "Ice Cream Studies in Cincinnati," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 11, p. 1009.

Other milk products subject to supervision are skim milk and buttermilk (see Rpt. of Commission on Milk Standards), butter, condensed milk, etc. Since butter is a potential vehicle of bovine tuberculosis, it should be made from tuberculin-tested or pasteurized supplies of milk or cream. Strict conditions of cleanliness should be observed in places where milk products are produced and handled, and so far as practicable pasteurization of the raw materials or finished product should be practiced.

ENFORCEMENT OF STANDARDS

Legal Remedies. — The following legal remedies are available:

1. *Fines.* — In connection with bacteria counts two or more consecutive excessive counts should be obtained as a basis for prosecution. With substandard chemical tests it is customary to issue a warning on the first tests, prosecution being undertaken if the supply continues below standard. The law should provide increasing penalties for subsequent offences. If fraudulent adulteration, etc., is proved, prosecution is at once demanded.

2. *Revocation of Permit.* — Where this is provided for in the law it affords a powerful check, which can, however, only be applied where conditions are continuously bad.

3. *Arbitrary Confiscation*, destruction or denaturization of milk is a comparatively rare procedure, too drastic for most cases. It could only be applied when the product contains visible dirt or has a very low specific gravity or is above temperature standard — in other words when the violation of standards is demonstrable on the spot.

Publicity of conditions and laboratory results (see below) is a valuable auxiliary means in the enforcement of milk standards.

The Economic Problem. — The improvement of milk supplies is at bottom an economic problem. Improvements require expenditure of money or of labor, and justice

requires and practice shows that an increased price must be paid by the consumer. The grading of market milks clears the situation greatly by enabling the better grades to be sold at the somewhat increased price that they merit. At the same time it may result in decreasing the prices now obtained for inferior grades. On the whole, however, improved sanitation means corresponding, though not necessarily great, increases in prices. Hence, while the health officer is setting and endeavoring to enforce higher standards he must also stimulate a public demand and willingness to pay for the better product; and this requires public enlightenment.

The success achieved by the experiment in milk production which has been carried out on a large scale by the New York Dairy Demonstration Company is an illustration of the fact that an extra price or premium paid to the producer for cleanliness and care will bring results far more quickly and certainly than instructions or official inspection. In this successful experiment the following premiums were paid to the farmers:

For tuberculin-tested cows	½¢ per quart
For "sanitation" (milking in covered pails washed and sterilized at the receiving station, and cooling with ice)	¼¢
For keeping bacteria count under 10,000 per c.c.	¼¢
Total	1¢

The additional cost of running the sterilizing station, over and above that of an ordinary bottling station, was ½¢, thereby making the additional cost necessary to supply a tuberculin-tested milk with a bacteria count under 30,000 at time of delivery, one and one-half cents per quart.[1] Similar additional costs might be worked out for pasteurization and other factors.

In future milk should be sold on sanitary grade and food value, the choice of quality resting with the consumer who

[1] North, "Sterilizing Stations in Dairy Districts," *Am. Jour. Pub. Health*, 1911, vol. I, no. 9, p. 654.

should have full knowledge of what he is getting and be willing to pay the corresponding price.

Publicity. — We have already alluded to the advantages of publicity in the improvement of milk supplies. The most effective form that this can take is the publication of the results of laboratory analyses, preferably in the form of quarterly or semi-annual bulletins which may be distributed from house to house. This method is particularly applicable to small communities. It enables the consumer to choose a supply more accurately than is afforded by the market grading system. In Montclair, N. J., much benefit has resulted in the publication of such results in the annual reports of the health department, a partial reprint of which is distributed from house to house. We assume of course that proper regulations have been established, that there are adequate laboratory facilities and that sufficiently numerous tests are made.

Circulars on the care of milk in the home may also with advantage be distributed.

Exhibitions, especially at the outset of a milk campaign, are useful.[1]

ORGANIZATION

The ideal organization for the administration of milk laws would involve a combination of *state* and *local* inspection and laboratory work. Under such a plan milk and milk products from the time of their origin at the dairy farm, in transportation, country bottling, etc., would be under the supervision of the state authorities (state health authorities in coöperation with state agricultural authorities); upon their entrance within the limits of the local municipality they would come under the supervision of the local authorities. The supervision in both cases would include both inspection and laboratory work. The local

[1] For suggestions see the Report of the Philadelphia Milk Show, 1911 (Phila. Bureau of Municipal Research).

municipality could enforce its own ordinances through coöperation with the state authorities, such coöperation taking the form of furnishing reports and evidence. The state inspection of dairies is obviously an advantage for the reason that overlapping in the same district of the inspections of several different municipalities is avoided, that a dairy condemned by one community cannot divert its product into another without detection and that more uniformity of methods may be secured. But whatever the relationships may be, the principal authority must naturally reside in the local health department, and when, as frequently is the case, the appropriations to state departments for milk supervision are insufficient to carry into complete effect the plan which has just been proposed, local departments must rely very largely, perhaps wholly, on their own resources.

The number of *inspectors* necessary will vary according to the number and distribution of the dairies and other establishments to be visited. One authority states that there should, as a rule, be one inspector for, approximately, every 100 dairies [1] for the country inspections; in addition there would be the inspection of receiving and bottling stations, and the collection of samples, which might perhaps be handled by the same man.

Besides the inspection service there must be *local laboratory facilities and services.* It is impossible to lay down exact standards as to practical requirements; the needs of each community must be considered. A number of

[1] Some of the questions relating to number of inspectors, of samples to be taken and the like have been considered by Gunn in a report on the milk control situation in Milwaukee (see reference at close of this section). He states that relatively the greatest amount of inspection is performed in Richmond, Va., where there are only 66 farms per dairy inspector. The Philadelphia Milk Commission recommended approximately 150 farms per country inspector (12 visits per year to each farm, on the average, some more and some less according to conditions at each).

cities require a milk analyst and one or more milk inspectors. In smaller communities, one inspector trained in both dairy inspection and laboratory work may be able to perform all the inspection and laboratory work required. Still smaller places may coöperate with neighboring places in the maintenance of a joint inspection and laboratory arrangement. Thus no community, however small, should be without adequate expert service.

In every case milk work should be a distinct branch of health department activity, requiring for its execution, men specially qualified by training and experience. Halfway measures and ill-advised methods lead invariably to failure if not to harm.

A special effort should be made to obtain the good-will of dairymen and dealers through tactful and instructive methods, to educate public opinion to higher standards and to use methods and statements which safeguard and improve and, without arousing needless apprehension, further public convenience and confidence.

REFERENCES

Reports of the Commission on Milk Standards appointed by the New York Milk Committee, N. Y. Milk Com., 105 East 22nd St., N. Y. City.

Savage, "Milk and the Public Health" (bacteriology and administrative control), London, 1912.

Jensen, "Milk Hygiene" (translated by Pearson).

Winslow (Kenelm), "The Production and Handling of Clean Milk, Including Practical Milk Inspection" (with "The Essentials of Milk Bacteriology," by H. P. Hill).

Ward, "Pure Milk and the Public Health."

Rosenau, "The Milk Question," 1912 (popular in style).

Magruder, "The Solution of the Milk Problem," R. Beresford, 605 F. St., N.W., Washington, D.C., 1913 (pamphlet, 10 cts.).

Trans. XV. Internat. Congress on Hyg. and Demogr., 1912, Govt. Printing Office, Washington (vol. IV).

A mass of useful information is contained in the U. S. Government publications, a list of which may be obtained from the Supt. of Documents, Government Printing Office, Washington, and in the publications of state agricultural experiment stations. These are partly the

results of official investigations and study, and partly in the nature of material for instruction of farmers and public. The sanitarian and health officer should consult especially Bull. 56 of the Hygienic Laboratory, Public Health Service, on "Milk in Its Relation to the Public Health."

As an example of a milk supply survey see "Report of a Special Committee appointed by the Washington Chamber of Commerce to investigate the Milk Situation in the District of Columbia," 1911, Senate Document No. 863, 61st Congress, 3d session; Gunn, "The Milk Supply of the City of Milwaukee and Its Control by the Health Department," Milwaukee Bur. of Efficiency and Economy, Bull. No. 13, 1912.

For laboratory references see Appendix D.

For references on transmission of disease by milk see Epidemiology, Chapter I.

II. FOODS OTHER THAN MILK

Regulation of food supplies in general is directed against the following classes of conditions:

1. *Infection.* — Preventive measures should forbid the possibility of contamination of foods at any stage with infectious matter, and, in the case of meats, the sale of dangerously diseased portions. The requirements of this class apply especially to foods eaten raw.

2. *Contamination with Dirt and Other Foreign Matter.* — Measures under this head may be referred to as "general sanitation" and are closely connected with those just mentioned.

3. *Decomposition.* — While it is obviously important that no decomposed foods be sold, this department of food inspection has been exaggerated as applied to foods which are obviously unfit for consumption. More attention might well be paid, however, to the character of raw materials used in restaurants and the like. The effects of cold storage on food supplies have come in for a good deal of attention of late.[1]

[1] Rpts. of Committee on Cold Storage of the Am. Pub. Health Assn., published in *Am. Jour. Pub. Health.*

4. *Adulteration, Preservatives, etc.* — This head includes substitutions, admixtures and subtractions which affect the quality or strength of articles; also the use of deleterious preservatives, and the use of coloring or preservative or other substance to conceal inferiority. We may include here also poisonous inorganic substances which may gain access to foods in the process of manufacture, canning, etc. Lead poisoning from beverages would likewise fall under this head. As to harmful and harmless preservatives the line is often difficult to draw and the term "poison" as applied in this connection difficult to define. For the whole question of harmful substances in foods and beverages the larger text-books (especially that by Wiley) should be consulted.

Many if not most of the violations under this head obviously bear upon honesty, the consumer's purse, etc., as well as health. The laws covering adulteration and misbranding of foods and drugs are chiefly administered by state and federal authorities.

On the whole, the main public health aspects of food supplies other than milk relate to those foods which may be infected and convey infection through being consumed in the raw state. Otherwise (leaving out of our present scope dietetic and nutritional problems) the matters here considered raise comparatively few responsibilities for the local health officer.

Meat Supplies. — Meats and meat products are objectionable if they are, in whole or in part, filthy or decomposed, or if they embrace any portion of an animal unfit for food, or if they are the product of diseased animals or those that have died otherwise than by slaughter. Such conditions are to be obviated through inspections of slaughterhouses, veterinary inspection of animals before slaughter and of the carcasses after slaughter, and supervision of handling. Such inspections are properly the

function of State and Federal authorities, though they should be performed by the local authorities where the former are inadequate. State systems of inspecting and licensing slaughterhouses and slaughtering are very desirable.

The fact that meat is practically always cooked before consumption is a vast safeguard against infection, but since cooking may be incomplete, the consumer should be protected by an inspection that ensures him products as nearly free from infection as possible. Seriously diseased meat is of course an unfit food under any circumstances, though when a diseased animal is affected only locally, only the parts affected need be condemned. Among the diseases which may be communicated from animals to man through uncooked meat may be mentioned tuberculosis, trichinosis, tape-worm and actinomycosis.

A great deal of meat is inspected by the Federal Bureau of Animal Industry, but it must be remembered that such inspection covers only products intended for interstate or foreign commerce, so that consequently large quantities of meat killed and consumed within state borders is, in the absence of state supervision, not subject to any inspection.[1]

MEAT INFECTION AND POISONING, "PTOMAINES," ETC.

Meat may become *infected* with bacteria of the paratyphoid or the hog cholera group, the infection being derived either from disease in the animal before slaughter or from postmortem contamination from soiled hands, butcher's tools or fixtures, cloths, dust, or other objects with which it comes in contact, or from flies. In this way there is an anal-

[1] The following ordinance has been adopted in Montclair, N. J.: "No pork, beef, veal, mutton or lamb nor any part of any animal from which any of said meats is obtained shall be sold for food purposes or exposed for sale or held in possession in a store in which food is sold, unless the said animal has been examined both before and after slaughter by a meat inspector duly appointed by the United States Government, or by some other competent public official, and has been passed as fit for food and has been stamped with a proper identification mark or marks according to the system adopted by the United States Bureau of Animal Industry. The provisions of this ordinance shall be construed to apply to all meat sausages and chopped meats."

ogy to milk infection. The bacteria have their usual habitat in man (paratyphoid bacillus) or lower animals (hog cholera bacillus, etc.), but when they gain access to meat and conditions as to warmth, etc., are favorable, they multiply readily. " Cases of meat poisoning vary greatly in intensity and also in their clinical picture. The period of incubation in the acute gastroenteric type is usually short, rarely over 48 hours; the period of incubation in the cases resembling typhoid fever is generally from 8 to 18 days."[1]

Meat inspection affords comparatively little protection against bacterial infections of this class for the reason that the bacteria may grow extensively without altering the perceptible qualities of the meat. Their presence may be detected only by bacteriological examination. Of course it goes without saying that animals having diseased conditions capable of producing meat infection should be condemned. Since infection of meat may take place any time between slaughter and consumption, scrupulous *cleanliness* should be observed in slaughter houses, butcher shops and the home. " The butcher's hands and implements," recommends Rosenau, " require cleanliness of a surgical order." Chopping and mincing favor infection of the mass of meat. *Thorough cooking* destroys the infection, hence cases of meat poisoning are rare among those whose food is properly cooked. Meat may, however, become infected after cooking if not properly cared for.

Botulismus is another type of meat poisoning, a true intoxication due to the production, by a specific saprophytic organism (*Bacillus botulinus*), of a bacterial toxine. Meat, fish and even vegetables containing sufficient protein are subject to infection by this organism — most frequently sausages, hence the name " sausage poisoning." The organism is a strict anaërobe, i.e., grows only in the absence of air and oxygen. It is in itself harmless and does not grow within the body; the poisoning is caused solely by the toxine generated in the meat before ingestion. Sometimes the presence of toxine can be detected by changes in color, taste, odor, etc., of the article; sometimes not. The period of " incubation " of the poisoning before symptoms appear is about 20 to 24 hours. Most of the cases of botulismus are reported from Europe. *Prevention* is a matter of care and cleanliness in the handling and preservation of nitrogenous foods. There is no danger in fresh or properly preserved foods. The chief danger is from sausages eaten without sufficient cooking. *Thorough cooking* destroys the toxine. The bacillus is capable of growing well, however, in cooked foods. A specific preventive antitoxin may be prepared by the usual methods.

[1] Rosenau, " Preventive Medicine and Hygiene," 1913, in which a fuller description of symptoms, etiology, etc., of diseases mentioned in this section is given.

Uncooked or insufficiently cooked meat may also transmit to man tuberculosis, tapeworm (from beef, pork or fish), trichinosis (from the hog), actinomycosis and other diseases of the lower animals, such as those we have mentioned in Chapter I.

" *Bob veal* " (from calves less than two or three weeks old), the sale of which has frequently been forbidden by health authorities, is objectionable on humanitarian and esthetic grounds, and is more subject to infection from the living animal and to bacterial growth and decomposition after slaughter than mature meat.

" *Ptomaine poisoning* " is a name given in common, and frequently in medical, parlance to any sickness supposed to be due to the eating of decomposed food. Chemically, the ptomaines are products of the putrefaction of proteins; they may or may not be poisonous. Some of them, at least, are not destroyed by the heat of cooking. This class of poisonings is obscure owing to the fact that few instances have been studied thoroughly, clinically, bacteriologically and chemically. Rosenau states that " the more the question of ptomaines is studied the less do they appear concerned in cases of food poisons. It is now clear that most, if not all, cases of so-called ptomaine poisoning are nothing more nor less than acute infections with *B. paratyphosus*, *B. enteriditis*, *B. cholerae suis* and other microörganisms belonging to this group " (see remarks on meat poisoning, above). Pellagra, a disease thought by some observers to be connected with spoiled corn, has already been discussed in Chapter I.

Establishments where Food is Prepared, Handled or Sold. — In a preceding section we have made some remarks relative to the supervision of ice-cream factories. Similar regulation should apply to *bakeries* and *confectioneries*, in which uncleanliness of equipment and methods and opportunities for infection of products by employees are frequently to be found. Since it is not practically possible to insure that the employees in such establishments are not carriers of disease, inspection is here the only safeguard against infection.[1] The following schedule [2] covers in a general way the points to be observed:

[1] Recently, however, the Montclair, N. J., Board of Health has adopted a requirement that all persons employed in the manufacture or handling of food in the class of establishments mentioned in this section file every three months medical certificates of freedom from evidence of communicable disease.

[2] Asbury Park, N. J.

1. Date Hour
2. Street and No.
3. Name of Owner
4. Address
5. Name of Proprietor
6. Business
7. Are foods exposed to flies, dust or dirt?
8. Is clothing of persons handling foods clean?
9. Is business conducted in a cleanly manner?
   If not give details
10. Construction of place where foods are sold or stored
11. Water-closet and lavatory provided? Are they separate from room where foods are sold or stored?
    Condition
12. Are cuspidors provided? Condition
    Any disinfectant used? What?
13. Store or storeroom used as a dormitory?
14. Are persons handling foods in good health?
15. Remarks

Inspector.

The above points should be covered by ordinance. The greatest importance should be attached to cleanliness of habits and methods on the part of operatives. All such establishments should be screened during the fly season. A requirement that bread be wrapped and that all food be properly protected against handling, dirt, dust and flies during transportation and while on sale may also well be adopted.

Similar remarks apply to *restaurants*, the methods in which are frequently objectionable. The same rules and inspection schedule, with any necessary changes, may be adopted.

Attention should be paid to *markets*, especially those in which produce which is usually eaten without peeling, paring or the like, or cooking, is sold. Such produce, embracing fruits and vegetables, should be protected, while on display or in transportation or storage, against flies and other contamination. To prevent the access of domestic animals, they should be kept on stands two and a half feet

or more above the ground. To attempt, however, to enforce complete protection against dust, may result in failure where there are large numbers of open-air stands and markets, although the health authorities should have power to prevent unquestionably objectionable contamination of any kind. Confectionery, pastry and beverages should be similarly protected.

At *soda fountains* and other places where beverages are sold, cleanly methods, including proper washing of glasses, should be enforced and the glasses and other utensils protected from fly and dirt contamination. Such glasses are in a true sense public or common, are used many times a day and should be accordingly strictly looked after. Special attention is to be paid to the rims, which experiment has shown may harbor numerous germs, and an after-rinsing in clean water is important. It would be desirable to have the cleansing take place within sight of the customer instead of in the dirty tanks not infrequently found.

Publicity. — Improvement in conditions will be accelerated by publicity on the conditions of the several establishments. Score-cards assist in this regard. The success of "consumers' leagues" in publishing white lists of praiseworthy commercial establishments is an example of what can be accomplished through publicity.

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Rosenau, "Preventive Medicine and Hygiene," 1913, sec. III, "Foods."

For laboratory references see Appendix D.

CHAPTER IV

WATER SUPPLIES

The importance of the purity of water supplies has already been sufficiently indicated in Chapter I. There it was pointed out that typhoid fever and other intestinal diseases are very frequently water-borne, and that, through the lowered vitality induced in those who survive attacks of typhoid, tuberculosis and other diseases may be indirectly increased. Even infant mortality may be heightened by polluted water supplies through its being given to infants to drink or through its use in washing bottles and other utensils.

To insure the degree of purity demanded in water for the sake of safety necessitates not only careful inspection of sources but also, from time to time, laboratory analysis.

INSPECTION

In the first place a great deal can be told by means of inspection alone. Some supplies can be condemned on inspection alone, and recourse to the laboratory is needless unless to obtain extra evidence for legal proceedings. On the other hand, it may be possible through inspection to establish a certainty, or nearly so, that a supply is safe, although confirmatory analyses should be made in important or doubtful cases.

ANALYSIS

1. **Bacteriological.** — In the analysis the most sensitive and important tests are the bacteriological.[1] Thus the

[1] See Prescott and Winslow, "Elements of Water Bacteriology," 1913.

presumptive tests for *B. coli* (the "colon bacillus," indicative of human or animal pollution) provide a searching means of gauging the sanitary quality. The making of frequent *B. coli* tests — say daily — would alone be a fairly satisfactory check on a supply. The total count of bacteria should also be periodically obtained.

2. **Chemical.** — When a searching study of a supply is to be made or confirmatory evidence to be secured, then it is necessary to make use of the supplementary means of chemical analysis. While the bacteriological results furnish a sensitive picture of conditions for the time being, the chemical afford something in the way of interpretation regarding the history of the water. This is due to the fact that the chemical traces of pollution and bacterial action persist long after the bacteriological indications have passed away, so that the exact state of a water relative to its past and future history can be indicated only by chemical methods.

The two branches of analysis complement each other, and both together supplement the findings of inspection. The more important the case in hand and the more doubt involved, the more extensive and detailed must be the methods. Laboratory results, as may be inferred from the above, cannot be interpreted without reference to inspection. Where the laboratory result is favorable there may still be threatening conditions to be perceived on inspection; while if it is unfavorable, sources of contamination should be located and the possibility (or impossibility) of their removal be ascertained.

In laboratory work on water the standard methods of the Laboratory Section of the American Public Health Association should be followed.[1]

3. In addition to the above tests it is sometimes necessary to make *microscopic examinations* for the detection of the minute animal and plant organisms to which

[1] See references, Appendix D.

are due various tastes and odors which occur in water supplies.[1]

Lead Poisoning from Water. — Certain waters dissolve the lead of pipes, producing chronic lead poisoning in the consumers. A great deal of lead piping is in use, even in modern plumbing work, and since lead-dissolving waters are not uncommon, it is probable that there are considerable numbers of undetected cases of such poisoning. Even short lengths of lead pipe may, under favorable circumstances, produce the poisoning. Lead is a cumulative poison, and even minute quantities taken successively are dangerous. "The purest, softest and best aerated waters are especially prone to act upon lead" (Rosenau). Turbid waters and hard waters are less apt to do so. "Water artificially charged with carbon dioxide, however, readily dissolves lead, so that lead piping and fittings in soda water fountains and in syphon bottles are dangerous. Beverages containing free acid may also dissolve it; the historic poisoning of Devonshire cider through the use of lead piping is an instance in point. Chemical tests will not determine whether or not a water will dissolve lead; suspected water should be examined for lead in samples taken under practical conditions. No water which contains even a trace of lead should be used for drinking purposes.[2]

In connection with water supplies there are also considerations other than the sanitary,—as, for example, proper chemical composition for household and manufacturing uses, adequacy for fire protection, etc.[3]

[1] Whipple, "Microscopy of Drinking Water," is the standard work on this subject.

[2] For further particulars see Rosenau, "Preventive Medicine and Hygiene," 1913, pp. 751, 810 ff.

[3] For discussion of sanitary and other aspects see Hazen, "Clean Water and How to Get It"; Whipple, "The Value of Pure Water" (in which monetary values for the various qualities of water supplies are worked out and combined in a formula), and Turneaure and Russell, "Water Supplies."

PUBLIC WATER SUPPLIES

Upon health authorities devolves the responsibility of supervision over the sanitary character of public water supplies. While much of the power necessary to secure protection of such supplies may rest with water boards and municipal councils, the sanitary authorities should exercise constant oversight, making known their findings to the proper authorities from time to time. This places the responsibility for taking direct action upon the water authorities in cases where it does not rest with the health department.

There are *two general classes of water supplies:*

1. Impounded surface water supplies.
2. Ground water supplies from springs or driven wells.

We shall consider first the former.

1. **Surface Supplies** are subject to pollution:[1] (1) from sewage and human excreta; (2) from animal sources; and (3) from trades and household (other than sewage) wastes and the like. Besides these there may be various contaminations of a less serious character.

Naturally, the most important class is *pollution from human sources*, which sooner or later means actual infection. Here the principal sources of pollution are sewage outfalls and drains, privies and the dumping of nightsoil where it may drain into the supply. The situation of habitations and camps on watersheds is always more or less of a menace, and where a watershed is open to public access, pollution may be caused by persons passing through it, by sportsmen, picnickers and the like. A single case of typhoid fever on a watershed may cause a great epidemic of the

[1] Distinction should be made between (1) "contamination," which denotes the access of objectionable foreign matter to the water, (2) "pollution," a stronger term, usually implying access of sewage matters, and (3) "infection," which denotes the actual presence of pathogenic organisms.

disease among the users of the supply, as was the case in the Plymouth epidemic (see Chapter I) and others. Since it is practically impossible to guard against carriers and unrecognized cases, the only safe course is to regard all human excreta as a source of infection. Where construction camps are located on a watershed the situation calls for the strictest measures; where it is necessary to tolerate such camps the arrangements for sanitary disposal of excreta must be perfect. Even so it is not always certain that random pollutions of soil and streams may not take place. It would be well, where laborers are employed on watersheds, to require that they be subject to the Widal test before being accepted and receive typhoid inoculation.[1] Trains passing through watersheds may distribute pollution, as was the case in epidemics at Scranton, Pa., and elsewhere. Such is the danger unless the drainage from railroad tracks is diverted from water supplies, until some form of sewage receptacle is attached to trains.

Animal pollution — which, however, is usually of secondary importance — may be produced by stables, pigstyes, live stock wading in streams and pasturing on land draining into the streams, manured fields, roads, etc. Some such pollution always takes place where supplies are drawn from inhabitated areas.

Trades and household wastes are of various kinds and more or less objectionable.

2. **Ground Water Supplies** are subject to pollution through the seepage of sewage and sometimes through breakage of pipes and other accidents which permit the access of polluted ground water. The possibility of pollution of aqueducts and the like by laborers is not to be forgotten. It is customary to store ground water supplies, which are rich in nitrate plant food, in covered reservoirs, otherwise the access of light permits the development of vegetable growths which, while not materially

[1] *Am. Jour. Pub. Health*, 1913, vol. III, no. 4, p. 390.

detrimental to health, impart disagreeable tastes and odors to the water.

Reservoirs should be safeguarded on the same principles as surface watersheds, but even more strictly. Boating, bathing, fishing, skating and the access of persons to the shores should be prohibited because of the danger of incidental pollutions through depositing of excreta in or near the water, spitting and other contamination.[1] Another argument to this effect is that persons sometimes drown in such bodies of water and that to recover bodies may necessitate emptying the entire supply or, in winter, when persons may break through the ice, waiting until the ice disappears. Such rules as the above curtail the freedom of comparatively few people for the obvious protection of a whole community.

Even when a water supply is subject to purification by filtration or otherwise, pollution should so far as possible be avoided, for the reasons, that increased pollution makes a water more difficult and expensive to purify, and that in case of possible accident to purification works there will be increased danger of epidemic.

Purification Methods. — Where it is necessary to make use of water supplies which would be unsafe in their raw state, some form of bacterial purification must be resorted to. This is a problem for the sanitary engineer. The following are the classes of methods in use:

1. Storage. — When a contaminated water is held for a number of days in a storage reservoir, a gradual purification process takes place. This consists in the settling out, through sedimentation (natural or aided with chemicals), of suspended matters (among which many of the microorganisms present), and through the natural perishing of bacteria in what is, to those of animal origin, an adverse environment. This is the process which takes place, to a greater or less degree, in all reservoirs where water remains

[1] *Jour. Am. Pub. Health Assn.*, 1911, vol. I, no. 9, p. 671.

for days at a time. Storage, or *sedimentation*, is a legitimate mode of purification which may be sufficient for some supplies where the amount of original pollution was slight and where long periods can be ensured, but in most instances it is a preliminary to more exactly governable means. The reason that it cannot be relied upon entirely in most instances is that it is not always certain. For example, currents may be set up in a body of water by temperature, wind or otherwise, which will permit the passage of polluted water pretty directly to the intake. Again, while sufficient at times, at other times it may not be adequate to take care of fluctuations in pollution. Finally, it may be sufficient during periods of little movement of water, but when rainfalls come — particularly following a drought — great quantities of polluted water may pass through the reservoirs with insufficient or no sedimentation.

The all-important factor in sedimentation is *time*. Contrary to what is popularly supposed, bacterial purification takes place in quiet water, not in running streams, in which the sediment and bacteria are kept stirred up. In the latter case aëration may take place and the water may be rendered more agreeable to the senses, but the more rapid the stream the more dangerous it is as a possible carrier of pollution from its frequently far-distant sources. The amount of time necessary for purification by sedimentation must be determined in each case by experiment and bacteriological study under local conditions. In many instances thirty days or more may be required to render a water safe, but no definite rule can be laid down.

2. Filtration. — Filtration is of two kinds: (1) *slow sand filtration*, in which the water passes slowly under a small head through large beds of fine sand, on the surface of which accumulates a "schmutzdecke" or organic layer which plays the principal part in the retention of bacteria; and (2) *mechanical filtration*, in which the water, after

having a chemical coagulant added to it, passes rapidly under a larger head through layers of sand in filter machines. Satisfactory results may be obtained with both processes, which, however, differ in the skill required for operation, the original and operating costs and the space occupied.[1] Filtration plants should be designed and built by competent sanitary engineers and operated under expert supervision and constant bacteriological control.

3. DISINFECTION. — A comparatively recent method of water purification consists in chemical treatment, the principal substance used for this purpose being *chlorinated lime* (bleaching powder, "chloride of lime").[2] This substance has been used for years in the disinfection of sewage and now has been applied with success in the treatment of waters which are somewhat polluted and in which there is not too much turbidity or organic matter. It is particularly valuable as an emergency measure. The amount of the substance necessary varies according to the composition of the water, the more being required the greater the amount of organic matter present. Experiment has shown that waters are rendered practically sterile by the addition of amounts of chlorinated lime (estimated as available chlorine) ranging from 0.1 to 5 parts per 1,000,000 parts of water (Rosenau).

In public water supplies, where the treatment is used regularly, an average of from 5 to 12 pounds per million gallons is applied. Expert supervision and bacteriological control are essential. Care should be taken that the hypochlorite used is up to standard — say 30 per cent or more of available chlorine. Twenty-five to 50 per cent more than absolutely necessary to practically sterilize is usually applied in order to guard against fluctuations in the composition of the water. The substance is not expensive,

[1] See Hazen, "Filtration of Public Water Supplies." (Cf. Rosenau, "Preventive Medicine and Hygiene," 1913, sec. VI, Chap. V.)

[2] Liquid chlorine is also now available.

is practically harmless and amounts of less than 25 pounds per million gallons are not detectible by the senses.[1]

Ozone has also been successfully employed for the same purpose in a number of instances, but chlorinated lime is cheaper and simpler.

Water purification in general is an art requiring the consideration of many circumstances and frequently the combination of different methods. The above remarks are intended merely as an indication of the broad principles of the subject. Details are to be left to the expert judgment and supervision of professional sanitary engineers, bacteriologists and chemists.

Official Responsibility for the purity of public water supplies rests, according to local conditions and laws, with local health authorities, with state authorities, or with both. Properly the supervision of the sanitary character of the various local public supplies should be vested in an expert division of the state department of health, which should also have control of public water supplies and sewage disposal throughout the state. Otherwise difficulty will be experienced in the control of sources located in or affected by districts other than those which they supply. In a few instances (e.g., the Metropolitan Water and Sewerage District of Boston and neighboring municipalities) several communities have united in the establishment and control of common supplies.

In one case at least it has been judicially decided that a municipality is legally liable, in the event of its negligence, for the damages from typhoid fever and other sickness caused by a polluted public water supply.[2]

[1] See Hooker, "Chloride of Lime in Sanitation," John Wiley and Sons, Inc., 1913, p. 16; Rosenau, " Preventive Medicine and Hygiene," 1913, pp. 797, 1019; Tully, "A Study of Calcium Hypochlorite as a Disinfectant of Water," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 5, p. 423.

[2] Minnesota, see *Am. Jour. Pub. Hyg.*, 1910, p. 912; 1911, p. 146.

PRIVATE WATER SUPPLIES

In small or rural communities where public supplies do not exist, recourse must be had to private or semi-public wells, springs and streams as sources of supply, and even after a public supply has been introduced the use of such private supplies continues to a greater or less extent. Since such private or semi-public sources are frequently polluted and present difficult problems of supervision in growing urban or semi-urban communities, their use should, in the presence of a safe public supply, be strongly discouraged. In places possessing wells and privies in close proximity to one another, dangerous pollutions are always to be looked for. Private supplies should be supervised, not only to safeguard the health of families possessing them but also because they are frequently used by numbers of people from neighboring families on account of their coolness, supposed superior quality, etc. The Broad Street pump epidemic of cholera in London in 1854 is a case in point.

What has been said as to the pollution of public surface water supplies applies also to streams, ponds and the like which are used in a private or semi-public manner and need not be repeated. The subject of wells and springs requires some further remark.

The *requirements* for a safe well or spring supply are:

1. That it be in itself a safe source; and

2. That it be protected by proper construction from possible contamination.

1. **Inspection.** — In the inspection, first the possibility of *subsurface pollution* is to be considered. In the absence of knowledge as to the subsoil and ground water from which the supply is drawn, a wide margin of safety should be allowed. The ordinary sources of pollution — privies, cesspools, drains, barnyards, etc. — should be looked for. Leaky and broken drains are not uncommon. While sources of water that are located uphill from possible sources

of pollution are in general safer than those which are lower down, this is not always the case, for the ground water level may slope in the opposite direction. Again, rifts and underground streams may exist in rocky, hard or clayey soils, conveying pollution from relatively distant points. In sandy soil natural purification of sewage *may* take place, but this cannot be determined by inspection alone, and, unless proved by laboratory examination, cannot be relied upon, particularly where the soil has long been saturated with pollution. Depth must be considered; deep driven wells are of course less liable to pollution than the shallow dug kind. No hard and fast rules for inspection can be laid down to cover all circumstances. In general, however, possible sources of sewage pollution within, say, 100 feet or so, should be regarded with more or less suspicion. Privies within suspicious distance should be of the sanitary type, with water-tight pits or receptacles which are regularly cleaned out and contents removed to a safe point. Nearby cesspools should be water-tight.

For the detection of underground pollution in suspicious cases the use of *dye* is to be recommended. That known as *uranin*, which may be procured from any chemical supply house, is as good as any. Some of the dye is sprinkled in the cesspool or other suspected source of pollution, thoroughly mixed into the whole body of the liquid, and then some time allowed for the color to appear in the water supply under observation. In some cases it may be necessary to make observations and repeated tests for several weeks before reaching a negative conclusion. Not a great deal of the dye need be used, and its appearance in an effluent in even minute quantities is readily detected. Uranin imparts a peculiar and very characteristic fluorescent or opalescent tinge to the water which is seen when a little of the liquid is taken in a glass. If the dye comes through the soil it may be presumed that bacteria may also do so; if the result is negative it should be confirmed bac-

teriologically and chemically. The test is not a substitute for bacteriological examination, but may be used in conjunction with the latter and is useful in indicating *sources* of pollution. Also, it may be readily available when the bacteriological method is not.

Surface contamination should then be looked for. Very frequently wells and springs permit the entrance of surface drainage in time of rain with the resultant washing in of extraneous and dangerous or at least detrimental matter.

2. **Laboratory Analysis** should be resorted to in cases of doubt. It need not, however, be applied to those cases where there is no reason for suspecting contamination, nor, on the other hand, where the contamination is so evident that no laboratory proof is needed.

Protective Construction. — When a supply is presumed to be originally of good quality attention should be paid to protective construction. Dug wells should be properly lined with stone or brick and should be surrounded at the surface with a top casing of cement, extending down the outside of the lining to a depth of one or two feet, rising *above* the surface of the ground say six inches or more, and sloping away all around for a foot or two, so as to ward off surface water from the mouth of the well. The covering should be entirely water-tight, and the passage of the pipe for the pump should be through a tight joint. Open-mouth wells are liable to more or less contamination. Similar principles apply to protective construction for driven wells and springs.

RURAL AND URBAN SUPPLIES COMPARED. — In rural districts, private wells and springs are the natural and only available sources of supply, and may be properly supervised. In closely settled communities, however, good public supplies should be adopted and all private supplies looked upon with great suspicion. Chances of pollution from privies, drains and sewers become numerous, and supervision of private sources of supply is such a difficult

and unsatisfactory matter that the health officer is justified in endeavoring to abolish all that are in any way open to suspicion.

Procedure to Abolish Wells, etc. — The usual procedure is to secure evidence, from inspection and, if necessary, from analysis, that the well (or spring) is an unfit source of supply, and then, acting under ordinance, serve an order entirely to abolish or to close the source. In the latter case the pump, if there is one, should be removed. Caution should be taken that the supply is not opened up again later, in the event of which strict action should be taken. In most instances such sources can readily be abolished by an order accompanied by an explanation that the water is deemed dangerous to health. Attempting to purify or disinfect wells is not advisable except in those few instances where the contamination is temporary and from the surface and its source can readily be removed; in such instances it may be possible to treat the water with a quantity of freshly burned lime or chlorinated lime (in the latter case enough to make a 1 per cent solution) and then pump the well out several times.[1] But the general rule is abolition or abandonment.

Oversight should be exercised so far as possible over *bottled waters* on the market, as well as over the sources of water used for the manufacture of carbonated beverages, both as to source and as to methods of handling and of cleansing of bottles. The best water-bottling plants practice sterilization of bottles and containers and other precautions.

Supplies of water for *dairy purposes* should receive special attention.[2]

[1] See Rosenau, "Preventive Medicine and Hygiene," 1913, p. 1034.

[2] See Prescott, "Farm Water Supplies, with Special Reference to Dairy Farms," *Am. Jour. Pub. Health*, 1913, vol. III, no. 9, p. 892; Fuller, "Underground Waters for Farm Use" (of general interest on wells, etc.), Paper No. 255 U. S. Geol. Survey; Fuller, "Domestic Water Supplies for the Farm," John Wiley and Sons, Inc., New York, 1912.

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Whipple, "The Value of Pure Water," John Wiley and Sons, Inc., New York.

On the sanitary engineering of private water supplies in rural or semi-rural districts:

Gerhard, "Sanitation, Water Supply, and Sewage Disposal of Country Houses," and Bashore, "Sanitation of a Country House."

For laboratory references see Appendix D.

ICE SUPPLIES

The subject of ice supplies need not detain us long. Bacteriologists agree that ice is greatly purified in freezing, and still further purified in storage. Epidemiological records fail to disclose that ice is of any particular importance in the spread of typhoid fever and other water-borne diseases even though in many instances ice is doubtless cut from polluted sources. The best known epidemic which has been attributed to ice is that of Ogdensburg, N. Y.[1] The U. S. Hygienic Laboratory (Bull. No. 35) after an exhaustive study of typhoid fever in the District of Columbia concluded that "ice plays little, if any, part in spreading the infection in the District of Columbia." Hill, speaking particularly of natural ice, states that there is no evidence for supposing that over $\frac{1}{1200}$ of 1 per cent of the water-borne typhoid cases can be attributed to that source, and considers this figure an exaggeration. While it cannot be denied that ice may, under unusual circumstances, when taken from a polluted source and used without much delay, act as a vehicle of disease, still "no considerable amount of disease has ever been satisfactorily traced to ice," and it

[1] Recently, however, Dr. H. W. Hill has studied the evidence in this case with the conclusion that it is contraindicative of ice as the real source. (Natural Ice Assn. paper; see below.)

"is plainly far less dangerous to the public health than is either water or milk" (Sedgwick).[1]

Natural ice profits by storage, an important protective factor, in addition to purification by freezing. The chief danger here is that particles of sewage and bacteria may be enmeshed in the ice in the process of freezing, as, for example, when polluted water overflows the ice sheet. With *artificial ice*, any such matters present (either in the water supply or derived from contamination in process of manufacture) would be frozen in; further, the product is consumed with little or no storage; actually, however, the danger from artificial ice appears to be very small indeed. Ice is low in bacteria and mineral matter and may well be used, through melting, for drinking purposes where a very soft pure water is desired.

Some degree of supervision is, of course, advisable, for there is just enough evidence to show that ice *may* sometimes act as a vehicle of disease. Such supervision consists in licensing dealers, inspecting sources to see that plainly polluted water supplies are not used (with tests of such supplies in doubtful cases), and ensuring that contaminations do not take place in manufacture or handling. Also, while ice tends to cleanse itself in melting and washing off, there are instances where in placing in water tanks it is handled with unclean hands, and in this way and by other such obvious possibilities drinking water supplies may at times become contaminated.

[1] See the papers by Sedgwick, Hill, Rosenau, Winslow, Jordan, Whipple, Porter, Sparks and others, published by the Natural Ice Assn. of America, 116 Nassau St., New York City. A summary of the few epidemics which have been attributed to ice is given by Rosenau, "Preventive Medicine and Hygiene," 1913, pp. 840–42.

CHAPTER V

HOUSING AND INDUSTRIAL HYGIENE

The term "housing" in its broadest sense includes conditions in ordinary dwelling houses, in factories, schools, public buildings, and in fact in any kind of habitation. As a rule, however, it is applied more particularly to dwelling houses, while factory sanitation, school sanitation, etc., are considered as separate subjects. In the present chapter we shall treat the subject in this more particular sense and shall moreover omit any discussion of conditions outside of the dwelling. Such surrounding conditions will be considered in the next chapter, under the head of nuisances, while for the present we deal with those exclusively interior.

The immediate environment of persons in their homes and places of ordinary occupation is obviously one of the most important objects of sanitary supervision. Vitality is depressed and thus disease of all kinds — most conspicuously tuberculosis — is favored by bad dwelling conditions, and through congestion, filth and dirty habits the routes of transmission of communicable disease are many and direct. On the other hand the improvement of this class of conditions is one of the most formidable problems with which health authorities are confronted, because of the fact that they are interwoven not only with established structural conditions but also — and even more important — with strongly entrenched habits and attitudes on the part of the people themselves. Hence the campaign must involve persistent popular education for results which, while far-reaching, will come but gradually.

HOUSING

Housing questions deal not only with hygiene but also with safety in construction, protection against fire, economic and social conditions, and other factors, mention of which must necessarily be omitted here, although they enter into every broad view of the subject. The following are the chief hygienic considerations:

1. CONGESTION. — The unsanitary conditions attendant on overcrowding are obvious. Opportunities for transmission of disease by contact are increased, while the factors of uncleanliness, bad ventilation, and the like (mentioned below) are favored. Community congestion means the crowding of dwellings into a limited area of land, the building of tenements, the cutting-off of light and air, and other disadvantages. Even more important is family congestion, which results in room overcrowding with a long train of attendant evils.[1] While there are economic and other conditions at work which make the remedying of congestion, and even its prevention, an exceedingly difficult administrative problem, the health authorities have certain clear duties to perform in restricting the number of persons who may occupy a certain air-space, in placing restrictions on the construction of new buildings and requiring necessary alterations of old ones, and the like.

2. UNCLEANLINESS. — This is an even more undesirable factor than overcrowding, particularly in regard to the dissemination of disease by contact. It is doubtless true, also, that uncleanliness and obnoxious conditions do in themselves exert a depressing effect — both directly and through psychological reaction — on the human organism, especially in the case of infants and the less robust adults.

3. LACK OF PROPER VENTILATION, LIGHT, ETC. — Under

[1] Veiller, "Room Overcrowding and the Lodger Evil," National Housing Assn. Publications, no. 18.

this head we group a number of remaining conditions of which the chief refer to ventilation. The lack of light has more of an indirect than a direct effect, in favoring uncleanliness and in being usually accompanied by faulty ventilation. Light itself, however, has some (though not a great practical) value as a germicide. Such are the reasons for the forbidding of the dark rooms which unfortunately are so often found in present day tenements.

In all of the above factors it will be seen that the *manner* in which people live is, without belittling the importance of proper dwellings and the providing of decencies and conveniences, of even greater consequence. Hence the necessity of raising standards of living through education, particularly popular instruction in the home. A great deal can be done in this direction by the public health nurses employed for tuberculosis and infant hygiene work. Proper school instruction in hygiene will also accomplish a great deal.

Plumbing Inspection. — Present-day sanitary science has dispelled traditional ideas as to the importance of plumbing inspection from the standpoint of health. Distinction must be made between disposal of excreta, which is of prime importance to health, and the practically negligible dangers from sewer gas. (Cf. page 445.) The supposed sanitary significance of plumbing inspection was inspired by the now destroyed sewer gas bogey. We now know that the subject is one affecting comfort rather than health. Plumbing inspection involves the application of a code of detailed trade rules regulating construction, and should properly be administered by the building or sewer department.[1]

[1] For treatment of construction see Gerhard, "House Drainage and Sanitary Plumbing," Van Nostrand Co., and Gerhard, "The Water Supply, Sewerage and Plumbing of Modern City Buildings," John Wiley and Sons, Inc.

Types of Dwellings. — The following are the general types concerned in the housing problem as related to private dwellings.

1. ONE-FAMILY DWELLINGS. — The promotion of this type of house is one of the main objects of housing reform. Such houses may be built detached, each with its own plot of ground; suitable inexpensive houses may also be built in blocks, with ground in front and rear. In the city of Philadelphia such dwellings have been developed with remarkable success.

2. TWO-FAMILY DWELLINGS. — Dwellings of this class may also be very satisfactory, especially when the landlord lives in one part of the house. There are two types in this class: (1) the double house with a party wall in the middle, with separate entrances on each side and each family having one-half the house throughout the entire building, and (2) that in which one family has the ground floor and possibly the basement, and a second family has the second floor, or sometimes the second and third floors, with separate entrances for each family. From a sanitary standpoint such dwellings may be quite as satisfactory as one-family houses.

3. TENEMENTS. — Here we class (though there are various definitions of tenement houses under various local laws) houses in which more than two families dwell independently but sharing common hallways. It is against this class that most of the housing reform effort has been directed. One authority (Veiller) states that "the tenement is neither necessary nor desirable." Nevertheless the tenement is a result of economic conditions which urge the economy of land; there are many thousands of tenements in existence and some will doubtless continue to be built. Health and housing authorities should, however, place strict regulation upon their construction and care, and the erection of new tenements (even the so-called "model tenements") should be strongly discouraged in

those places (such as small cities) where there is little or no economic excuse for their existence. Even in the larger cities, with the extension and cheapening of rapid transit it is to be hoped that suburban dwelling may be so developed as to do away in a large degree with the demand for tenements. We need not here discuss the various schemes for housing in "garden cities" and the like which have been proposed; these, while admirable, belong in the realms of private enterprise and philanthropy and not in that of public administration.

The housing problem is not, however, limited to tenements. Very frequently conditions found in houses technically of the one- or two-family class are quite as bad as those in tenements. The health officers of small towns and cities will find this often to be the case, so that even where there are no tenements whatever serious housing problems may exist. Housing codes should, therefore, deal with small houses as well as multiple dwellings. Sometimes improper construction or care by the landlord will be found; also frequently (especially in rapidly growing industrial communities) the crowding of more than one family into a "one-family" house, and of more than two families into a "two-family" house. Again, the lodger evil is to be met with in all types of dwellings. The overcrowding of private families by the taking in of lodgers is frequent in industrial communities, especially among the more ignorant immigrants.[1]

A distinction in all housing regulations should be drawn between *old* and *new* buildings. It is clear that while old buildings may be altered only with considerable expense and difficulty, strict regulation may readily be applied in the construction of the new. In the former case regulation is remedial and comparatively limited, while in the latter it is preventive and of a wide scope.

[1] See reference, p. 421.

Public Buildings. — The principal points requiring attention in public and semipublic buildings — such as schools, churches, factories and workshops, theatres and moving picture shows, public baths, court houses and other municipal and state buildings — are cleanliness, lighting and ventilation. The last-mentioned factor requires the most attention of all, for in the buildings of this class proper ventilation is the exception rather than the rule. Yet, since vast numbers of people spend many hours of their time in such places there is here a distinctly important field for public health work.

In such buildings artificial *ventilation systems* play a prime part. The installation of such systems is the work of expert sanitary and mechanical engineers and architects, but it is the duty of health authorities to make inspections and tests of air (see below), to require the installation of systems where necessary and to insure their adequate operation. The failure of some ventilating systems in the past is not (as some have thought) an argument for returning to "natural" ventilation, but simply for more expert construction and operation.

Ventilation. — The chief requirements of present ventilating science are cleanliness of air supply, gentle motion, and temperature and humidity adjusted to the ordinary exercise of the occupants. Considerations of these kinds have taken the place of the formerly all-important chemical ratios of oxygen and carbonic acid, which are used now simply as indicators of the vital conditions. The cleansing of air supplies of dust and other impurities by mechanical and chemical methods is an important innovation, for the outside air of modern communities is frequently heavily laden with such impurities; and the partial re-circulating of artificially cleansed inside air even is practiced. At the same time, while present emphasis is placed on the physical factors, the important question of the chemical freshness of air as affected by minute quantities of certain volatile

substances present has not yet been cleared up. The subjects of ventilation and ventilating engineering are now developing very rapidly, and the health officer should be familiar with the latest developments.[1]

The first health department, so far as the writer knows, to take up the systematic supervision of the ventilation of public buildings was that of Chicago, which in 1912 established a Division of Ventilation. Physical and chemical tests are made in workshops, stores, theatres, street cars and other places. A minimum quantity of air supply is required for each class of place. The regulations, methods, instruments and forms adopted in Chicago will well repay the study of health departments taking up this class of work.[2] The Chicago requirements (1911) for air-renewal range from 1200 to 2000 cubic feet per hour per person, according to the class of establishment; there are also requirements as to air space, source of air supply, drafts, etc. Thorough work requires the scientific use of psychrometers, thermometers and other instruments, and

[1] See Rosenau, "Preventive Medicine and Hygiene," 1913, sec. IV; Kimball, "Present Status of Ventilation," *Trans. XV Internat. Congress Hyg. and Demogr.*, vol. IV, part II, p. 547; Winslow, "The New Art of Ventilation: Some Principles which Follow from Recent Physiological Research," *ibid.*, p. 560; Winslow, "School Ventilation in New York City," *Am. Jour. Pub. Health*, 1913, vol. III, no. 11, p. 1158; Phelps, "Some Fundamental Physical Factors in the Problem of the Control of the Atmospheric Environment," *ibid.*, p. 1123; Bass, "An Experiment with Ozone in School Ventilation," *ibid.*, p. 1135; Eager, "Indoor Tropics: The Injurious Effect of Overheated Dwellings, Schools, etc.," Suppl. no. 2 to the U. S. *Pub. Health Rpts.*, Jan. 31, 1913. The N. Y. Assn. for Improving the Condition of the Poor received in 1913 a large bequest for investigation of the problem of ventilation; the work of the New York State Commission on Ventilation appointed at its request is to be viewed with much interest. Among books may be consulted Macfie, " Air and Health." For laboratory work on air see Appendix D of the present work.

[2] Described in a series of articles by Dr. E. Vernon Hill in the *Metal Worker, Plumber and Steam Fitter*, Oct. 4 and 18, Nov. 8 and 22, and Dec. 6, 1912.

proper regulation requires temperature and humidity standards even more than mere space and air-supply requirements.

Air Poisoning by Illuminating Gas. — Recent scientific investigation set forth in an important paper by Sedgwick and Schneider[1] has demonstrated the dangerous properties of illuminating gas in indoor air, even when existing in very small quantities. These authors preface their paper with the following observations:

> Sooner or later students of infectious diseases must give closer attention than they have yet found time to give to those environmental conditions which increase or diminish susceptibility to the various infections. When they do this, it will probably be found that obscure poisonings of various kinds play a large part in diminishing vital resistance and in increasing susceptibility. The facts presented in the present paper may be taken as a contribution to this end, for they show how in urban communities one of the commonest of public supplies — the ordinary gas supply — is to-day a constant menace to the public health, attended as it is not only by numerous fatalities but also by many non-fatal poisonings which signify widespread atmospheric impurity in urban dwellings. . . . But the reader must not suppose that [fatalities] alone are of importance. Probably even more important are various obscure consequences of the leakage of illuminating gas in private dwellings, in public halls and in public streets, which are as yet seldom thought of and even more seldom detected.

After statistical studies, mainly of twelve hundred odd deaths from illuminating gas poisoning in Massachusetts in the preceding twenty years, the authors discuss the composition of commercial illuminating gas and conclude that an increased danger was introduced with the increase in the proportion of the more dangerous modern water-gas as compared with the old-fashioned coal-gas.[2]

Through the above study two lines of public health *con-*

[1] Sedgwick and Schneider, "On the Relation of Illuminating Gas to Public Health," *Jour. Inf. Diseases*, 1911, vol. IX, no. 3, p. 380.

[2] The approximate proportion of the dangerous constituent, carbonic oxide, in coal-gas is 7 per cent, in water-gas 30 per cent.

trol are indicated: first, limitation by law of the percentage of the dangerous element, carbonic oxide;[1] second, measures to prevent the leakage of gas in streets and houses. The former should be urged upon state legislatures; the latter should be attended to by local authorities through *gas inspections*, which require:

1. *Standards for the construction of gas fixtures* (so as to eliminate cheap and faulty fixtures), and supervision of the installation of gas piping and fixtures.

2. *Regular inspections of piping and fixtures* in tenements (perhaps to some extent in one- and two-family houses) and public buildings to locate leaks and cause them to be repaired. Attention should be paid to possible leaks in entering mains underneath houses, from which gas may rise and permeate the house air. Tenants become used to the atmospheric conditions in their houses and practically never investigate the sources of gas odors or think them dangerous to health. Such inspections require no apparatus beyond a reasonably keen sense of smell (which is readily cultivated) on the part of the inspector. Simple inspection blanks may be used, together with red tags bearing some such phrase as "Defective — Not to be removed except by an officer of the board of health," to be attached to leaky pipes and fixtures on the first inspection and not to be removed until the owner, in response to notification, has remedied the defects and a re-inspection has resulted in approval.

Inspection of *new* installations prevents careless work and the use of defective piping and fixtures. Appropriate pressure tests may be applied. In the inspection of *old* systems it will be found that many of the cocks of jets and other domestic fixtures become loose and leaky through the drying-out of the lubricating grease.

[1] The authors urge the former 10 per cent limit of Massachusetts, which would mean that the percentage of water-gas allowable in any mixture would be strictly limited.

Such supervision of new and inspection of old installations may readily be carried on by the officials responsible for plumbing inspection. It is a duty of the local health authorities either to institute this branch of activity themselves or to urge its adoption upon the authorities responsible for plumbing inspection. This is all the more necessary now that water-gas, which has little warning odor as compared with coal-gas, is extensively supplied, and it may be difficult to secure legislative restriction of its use. A number of health departments regulate new installations, but the inspection of old installations is unfortunately as yet uncommon.[1] The strict regulation which in the past has been, and still is, exercised against the escape of sewer gas, which we at the present time know to be innocuous or nearly so, should now be turned to the vastly more important problem of illuminating gas.

Publicity as to the deleterious effects of leaking gas in dwellings and the desirability of thorough ventilation, particularly at night, is obviously advisable.

How to Attack the Housing Problem. — It is a mistake to suppose that housing problems are limited to the slums of large cities. Even in small towns, particularly if they be rapidly growing industrial communities, the typical evils appear in run-down or overcrowded houses of ordinary types, while if tenements of improper types have begun to appear the situation demands all the more attention. In taking up the problem health authorities must, however, remember that important factors other than sanitation are concerned, and frequently they will find the coöperation of private organizations very useful. Housing campaigns are perhaps usually initiated by such organizations.

[1] This important class of inspections may readily, and should, be taken up by the plumbing inspector, especially during those months when there is a minimum of plumbing inspection. Such a plan was instituted under the supervision of the writer at Orange, N. J.

The following steps are necessary in a campaign for housing reform:[1]

1. *A Survey of the Conditions.* — This should properly be carried out by the constituted health authorities, or at least, when it is necessary to rely on private societies for funds to carry out the investigation, with official coöperation. Such a survey need not be exhaustive, but should be sufficiently thorough to demonstrate clearly the typical evils which exist, their approximate extent and the necessary remedies. If it is part of a general public health survey all the better. Such surveys should evidently be accurate and built up on a backbone of statistical findings, and should be conducted under expert direction, which it may frequently be necessary to engage for the occasion.

2. *Publicity.* — The making public of the findings prepares the ground for obtaining necessary legislation and increased health appropriations.

3. *Legislation.* — Revised legislation is usually necessary. It should be adopted in accordance with local needs, considering the future as well as the present, and the best present-day practice.[2]

Distinction must, however, be made between regulations which have for their object safety and decency, dealing with construction, water pressure, fire risks, etc., and those relating directly to public health. The former are properly the business of the municipal building inspector or department of building inspection; the latter only of the health department. Since everything not relating directly to health should be assigned to the building department, leaving the health department to deal intensively with its own problems, it is not practicable to combine all housing regulations in a single "code." Those portions of such a

[1] See Veiller, "A Housing Programme," Nat. Housing Assn. Publications no. 16.

[2] See Veiller, "A Model Housing Law" (Sage Foundation Publication), Survey Associates, Inc., 105 East 22nd St. N. Y. City, 1914, $2.

theoretical code which bear specifically on health should therefore be incorporated in the ordinances of the board of health, and the division of responsibility between building inspection and health departments should be clearly defined. Otherwise those duties which are ambiguous will fall into either conflict of authority or neglect. Every set of health regulations should contain a minimum of requirements covering the ground which we have already sketched, e.g., the subjects of light and ventilation, cleanliness, avoidance of overcrowding, lodgers, water for domestic purposes, convenient and proper plumbing, safe gas piping and fixtures, and the like.

4. *Enforcement.*—The general enforcement of regulations relating to houses can only be accomplished by means of *regular house-to-house inspections.* In these the object should be to make a brief but thorough survey of each house and premises, the inspections being made not less often than once a year. Merely waiting for complaints will produce practically no results. Such inspections should cover the building, plumbing (and gas piping and fixtures unless otherwise provided for — see remarks in a preceding section), and out-premises. Ordinary nuisances should be looked for, including fly and mosquito breeding, unless there are special inspections for these purposes. The records kept should be of the simplest description, consisting simply of a list of points for the inspector to check off and brief forms for entering reports of objectionable conditions found. The mistake is sometimes made of making these house-to-house records so detailed that a great deal of time is wasted in filling them in with information which is of little or no subsequent use. The proposal has been made that house-to-house inspection be made by women inspectors, who might combine some sanitary instruction with their inspectorial functions, and this is worthy of consideration. It is work which might well be done by women and would be of special value in those frequently occurring

instances where the blame for unsanitary conditions lies with the habits of life of the tenants and the difficulty can only be permanently remedied through education.

In some of the states the responsibility for the supervision of tenements rests with a special *state tenement inspection department.* While this is very desirable where there are large numbers of such dwellings, their existence does not relieve local health authorities of the responsibility of coöperation and of attending to many of the minor conditions which can so much more readily be attended to by the local inspectors constantly on the spot than by those from the tenement department, who may visit the town only at considerable intervals. This remark applies especially to a large class of minor complaints and nuisances which frequently arise on tenement premises. It is improper, therefore, for local officers to omit inspections of tenements simply because a tenement department has more extensive powers therein; these latter are to be resorted to only in the more difficult and special cases. It must be remembered also that the powers of tenement bureaus do not usually extend to dwellings housing fewer than three families (consult local state laws for definition of powers). In order to assist in the administration of the tenement laws it would be wise, wherever legally feasible, to pass an ordinance incorporating (by title) the state tenement house law into the ordinances of the local board of health in so far as it relates to light, air space, sleeping quarters, dirt and filth, storage of refuse, sewer connections, plumbing, cesspools, and privies, and providing a local penalty for violations. This also furthers a desirable consistency between state and local requirements.

The enforcement of sanitary housing regulations involves relationships between health officer, landlords, tenants and janitors, the management of which requires justice and tact. Care should be taken to fix *responsibility* as exactly as possible, for injustice in this regard destroys

respect for the authorities and leads to bad feeling among the various parties, leading to defeat of the law. Landlords are as a rule ready to comply with just and reasonable orders (even though involving considerable expenditures) if they are convinced of the necessity and are satisfied that the law is also being impartially administered in respect to other landlords. Very frequently, however, tenants are at fault but believe that the authorities will place the responsibility on the landlord; the health officer should not be misled by this attitude but should proceed vigorously against the tenant. Sometimes the fault lies with ignorant or careless janitors. The importance of the functions of the janitor are not sufficiently recognized; in schools and other institutions they play a prominent part,[1] and in tenements greater care in their selection on the part of landlords would result in saving trouble, money and public health and convenience. Another factor in regard to housing supervision is the police, who not infrequently meet with conditions which should be referred to the health department (see page 446).

CONCLUSION

Little has been done by health officials in this country to approach the housing problem in its deeper conditions. The reason for this is clear. Public health is only one aspect of a large problem which must be attacked coöperatively from several directions. Safety, economy, morality make it a sociological problem as well as a merely sanitary one. In dealing with it from the sanitary point of view we find that results are indefinite, slow and that the factor of personal hygiene is so great that education must play a large part. For such reasons health officers must frequently have felt that limited funds and efforts could and should be expended in ways which would bring more immediate and demonstrable results. Nevertheless, hous-

[1] See Putnam, "School Janitors and Health," 1913.

ing will always remain one of the prime influences on health, to which every health department should pay as much attention as is consistent with its other duties. There is, perhaps, no other field in which preventive measures should look so far ahead, and should so anticipate the evils of growing communities. Such evils are far more easily prevented than cured. In such efforts it should, so far as practicable, coöperate with the local building department, local and state housing organizations and departments, and other organizations working toward similar ends.

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INDUSTRIAL HYGIENE

The hygiene of occupations is manifestly of the greatest importance to the public health, ranging as it does from the simplest work done in the home through all the various kinds of workshops, stores, offices, etc., to the complex industrial organization of great factories. Our treatment of the subject here must necessarily be of the most general character, for industrial hygiene is a vast separate department of sanitary science and art, the details of which cannot be treated in a cursory manner. Moreover, the problems of each community present individual characteristics depending upon the local industries. The latter and their effects on the public health should be the subject of special study by the health officer of each community possessing any industrial population. A distinction should also be made between those factors pertaining to personal hygiene and which are best dealt with by education in personal hygiene, and those of a public nature which may be controlled by public authorities.

Factors. — The problems involved in industrial hygiene relate to hours of labor, to fatigue under various conditions, to the labor of children, to the labor of women as it affects both them and their offspring. In factories and workshops (as in dwellings) are met problems of ventilation and of detrimental substances (dust, fumes, etc.) in the air, of cleanliness and decency, and of transmission of infection (as by spitting). Of a more special nature there is a great class of problems relating to *diseases of occupation*, each industry exerting its own particular deleterious influences on health which are to be counteracted. In addition to the sanitary considerations there are questions of safety, of efficiency, and of social well-being which are connected more or less directly with those of health. No community can afford to neglect the problem of industrial hygiene, for even where no factories, properly speaking, exist, there are always such establishments as bakeries and other places where food is prepared, laundries, etc., in which the health of the workers is an important consideration. We have already referred in a previous chapter to the sanitation of food establishments; there, however, having the purity of the products in mind, while here the question relates to the workers.

Control. — While the whole problem of industrial hygiene is usually not to be attacked single-handed by the local health authorities, there are certain regulations which they can and should make and enforce, especially where no special system of factory inspection exists. Such regulations would cover ventilation (see preceding pages) and deleterious substances in the atmosphere. Proper artificial ventilating systems might well be required in instances where natural ventilation is not sufficient to keep the temperature and humidity down to a proper standard and the air reasonably free from injurious constituents. Cleanliness should be required. Promiscuous spitting in workshops should be forbidden and proper receptacles for

sputum, such as to obviate possible infection, should be required where necessary. Cleanliness and decency in water-closet arrangements should be insisted upon, together with the provision of proper lavatory facilities. Such regulations should be enforced through sufficiently frequent inspections.

Some hygienic instruction of the workers, especially in the hygiene of their particular trade, is of great value, for, as Oliver remarks, "no matter what . . . legislation may enact, industrial hygiene will never be secured until the workers themselves are educated in regard to the dangers incidental to particular trades and are willing to coöperate in making . . . regulations effective." Such instruction may consist in talks delivered in coöperation with trades organizations.

The medical examination of workers, e.g., for tuberculosis and other conditions, is an important movement. Factory inspection authorities or employers have taken this up in certain instances.

Other sweeping matters are usually, as they should be, dealt with by *statutory legislation administered by state factory inspection bureaus:* questions of hours and methods of labor, of child and female labor, of the special measures to be adopted for safety and for prevention of diseases of occupation.[1] In several states, following the excellent example of Wisconsin, the reporting of industrial diseases by physicians is required. Among the more common occu-

[1] Such diseases are classified by Oliver as follows: — (1) due to gases, vapors, and high temperatures; (2) due to conditions of atmospheric pressure; (3) due to metallic poisons, dusts and fumes; (4) due to organic or inorganic dust and heated atmospheres; (5) due to fatigue. To these conditions might be added lighting and optics in relation to eye-strain and nervous disorders, to which considerable attention is now being paid. Other causes of nervous strain, e.g., unnecessary noise, etc., should also be considered. Such classifications as the above are, of course, arbitrary; each occupation requires individual study and special measures of control.

pational diseases may be mentioned: poisoning by lead, phosphorus, arsenic, mercury and brass; caisson disease; and parasitic diseases, as anthrax ("wool-sorter's disease") and hook-worm (miners). The relation of dusty trades and other depressant industrial conditions to tuberculosis is a highly important problem (cf. page 160 f.).

The *statistics* of industrial disease form an important special branch of vital statistics. In dealing with such figures particular caution must be exercised on account of the many factors involved and the consequent liability to misleading results.

With increasing effectiveness, the country over, matters of industrial hygiene are being dealt with by legislatures, by specially established state factory inspection bureaus, by employers, and by employees' organizations such as the trades unions. A coöperation of all these is evidently demanded. Such coöperation sometimes takes an official form, as in the Joint Board of Sanitary Control, composed of representatives of manufacturers, employees and public, for the regulation of the sanitation of the cloak and suit industries of greater New York. The American Museum of Safety (29 West 39th Street, New York City) acts as a center for the dissemination of information relating to industrial safety and hygiene. The work of the National Consumers' League and the American Association for Labor Legislation (publishing *American Labor Legislation Review*) also demand high mention.

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Among other sources of information not already mentioned are: the transactions of the International Congresses on Hygiene and Demography (vol. iii, part ii, of the *Transactions* of the XV Congress) and of the National and International Congresses on Industrial Hygiene; reports of the various state factory inspection bureaus; reports of English Parliamentary Investigating Committees; etc.

The *American Journal of Public Health* publishes a department on Industrial Hygiene and Sanitation, and the American Public Health Association has a Committee on the subject.

CHAPTER VI

NUISANCES

"A nuisance," wrote Blackstone in his famous Commentaries on the law, "signifies anything that worketh hurt, inconvenience, or damage." To this it may be added that to constitute a nuisance in the legal sense there must be substantial damage resulting from an unreasonable use of property or liberty. "A private individual may not use his property or his liberty in such a way as to do any substantial damage to his neighbors or to the whole community, and he must conduct his business, however useful it may be, in a way that is reasonable."[1] Just what is substantial damage and what constitutes unreasonable use under given circumstances are questions for proof and judicial decision in doubtful cases, for the class of nuisances has no hard and fast boundaries. Under this general definition nuisances at law constitute a large class of wrongs, some of a private, some of a public nature. Out of that large class we are here limited to nuisances of a public nature which affect (or are presumed by tradition or the law to affect) health.

Health authorities are vested with very general powers over nuisances of this latter group, and are even permitted to define what shall be deemed to constitute nuisances. Such definitions, however, are restricted by traditional ideas as recorded in common law, and are subject to review

[1] Wambaugh, "Nuisances, Under the Law," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 2, p. 145. The standard legal work on nuisances is Joyce, "Law of Nuisance," 1906.

by the courts to determine whether they are in accord with those ideas in instances where actual detriment to health is difficult or impossible to prove. In addition, legislatures may define and declare specific nuisances, which are then before the law *ipso facto* nuisances beyond debate. In short, health authorities have power to deal with *nuisances of three classes: (1) those traditionally accepted; (2) those which they can prove detrimental to health under general powers for the protection of public health; and (3) those specifically defined by statute law.*

The first class includes, among others, many conditions, which, according to modern scientific ideas, are of little or no demonstrable detriment to health, but which frequently tend toward questions of comfort or decency. These have come down to us from times when the sources of disease and the conditions affecting health were less fully understood than now. Still they involve considerations of cleanliness, proper disposal of waste matters, and the like, which are of importance in indirect (and sometimes in direct) health protective measures. Under the second class might be included a large number (in fact theoretically all) of the conditions affected by public health regulations; this class may be enlarged as far as injury to health can be proved. Under the third class, legislatures make any specific definitions required.

The heterogeneous body of nuisances dealt with by health authorities may be arranged in a *practical* manner as follows:

I. Nuisances involved in the Disposal of Wastes:

1. Disposal of human excreta.
2. Disposal of other wastes (garbage, manure and other refuse).

II. Nuisances due to Insects and Vermin:

1. Flies.
2. Mosquitoes.
3. Other insects and vermin.

III. Miscellaneous Nuisances: [1]

1. Spitting.
2. Air contamination (smoke, dust, gases, obnoxious trades, etc.).
3. Noise.

Relation of Nuisances to Health. — So much of the activity of health authorities, traditionally and at the present time, is concerned with nuisances that a clear idea of proportion must be preserved. The various nuisances under the above classification should be given very different weights in the sanitary scale, and the health authorities should consider them in accordance with those true weights.

Thus, under group I, the disposal of excreta and sewage is of paramount weight, for here the important problem of typhoid fever and other intestinal diseases is vitally concerned. The disposal of all other kinds of waste, from garbage down to ordinary dirt, is of decidedly secondary weight, for such waste influences the spread of disease in only a very indirect manner.

Under group II the question of the propagation of disease is of greater or less importance according to circumstances. Where flies are numerous and excreta or other source of infection are exposed, particularly in warm climates, the suppression of flies becomes a serious consideration; under other circumstances it may be a minor matter. Where malaria and yellow fever exist, the suppression of mosquito-breeding is a first duty of the health department; otherwise it is rather a matter of public comfort and property values. Similar consideration applies to rats; ordinarily they produce simply a problem of economic destruction, but when plague appears they become almost the whole object of attack.

The nuisances of group III are also of varying impor-

[1] Any thing, condition or act detrimental to health in addition to those mentioned here may also in general be defined as a nuisance, e.g., polluted water supplies, rooms and dwellings unfit for occupancy, etc.

tance according to circumstances. The rôle of the public spitting nuisance in the spread of tuberculosis, etc., appears to have been exaggerated, relatively to more direct modes; but when promiscuous spitting is frequent, or when it takes place in factories and workshops and under other conditions of confinement, it becomes a clear danger to health. Again, air pollution is of greater or less importance according to its degree and nature.

The conclusion to be drawn from all these considerations is that health authorities should pay first attention to those nuisances which are actually and distinctly detrimental to health rather than to those which have only an indirect connection with it or are merely the subjects of a mistaken popular clamor.[1]

While it is true that health is connected with questions of comfort and decency, and that general measures for cleanliness and a wholesome environment are a part of the public health campaign, nevertheless it is the duty of modern health authorities to devote the bulk of their resources — always limited — to the suppression of direct and specific causes of disease. There has been far too much vague and general dealing with nuisances without discrimination as to the importance of some and the non-importance of others; health officials should abandon this outworn policy, and the public should be educated to respect the more scientific attitude. Non-sanitary nuisances will be further discussed presently.

Legal Remedies for Nuisances. — Granted that evidence has been obtained that a nuisance exists, health authorities have, in general, several legal weapons at their disposal.

1. Suit for Penalty. — Every local board of health should have among its ordinances sections, passed under the general authority of statute law, defining the various

[1] Probably less than one-quarter of the nuisances in sewered communities relate directly to health. The true sanitary nuisances are chiefly those connected with disposal of excreta.

kinds of nuisances subject to sanitary control and providing penalties for the persons responsible for maintaining them. The commonest and altogether the most effective method of dealing with a nuisance is then to serve a notice on the responsible person, describing the nuisance and ordering its abatement either forthwith or within a stated time. (Such notices and all procedures should be in strict accordance with the provisions of the law.) Even if such notice may not be explicitly required by law, it is customary and reasonable to take this action in order to allow the responsible person opportunity to abate the nuisance in time or to be heard by the health authorities so that he may state any justification which he may wish to put forward. If, however, the order is not complied with and there appears to be no reason why it should not be, then legal action may be started for collection of the penalty incurred. This usually results in the abatement of the nuisance, though it may be necessary to sue repeatedly for penalties or even to carry an appeal to higher courts. On the whole, the method of suit for penalty is simple, convenient and brings prompt results.

2. Abatement by Health Authorities. — The law sometimes provides that if the notification of the health authorities is not obeyed, they may proceed to abate the nuisance themselves and charge the costs on the property. This method is applicable in instances where the owner cannot be readily reached by notice, and where the nuisance is of a pressing character. It is, however, little employed and should be used with caution for the reasons that the abatement must be very fully justified in the eyes of the law and that the collection of the costs is likely to prove difficult.

3. Injunction. — Under special circumstances application may be made to the proper court for an injunction to enjoin, or restrain, a person or corporation from committing or maintaining, or continuing to commit or maintain, a

nuisance. This procedure applies especially to nuisances arising from factories and the like, where ordinary penalties are inadequate and where a more drastic remedy for a serious nuisance is desired. It has the advantage, not possessed by the other methods, of forbidding a threatened nuisance and of acting as a weighty check over longer periods of time. It is likely, however, to be slow and costly and to involve considerable legal question, and hence, as already remarked, is to be reserved for very special cases.

Under some circumstances it may be advisable to proceed simultaneously under two or more separate procedures.

Private Remedies. — Aside from the powers possessed by public health authorities, private persons have certain important remedies against nuisances which directly affect them as individuals. For demonstrable injury to property, a suit for damages may be instituted, or application may be made for an injunction to abate an existent nuisance or to prevent a threatened one. Where annoyance exists, though no injury to property, a grand jury indictment may be secured. In these cases it is to be noted that injury to health need not be proved, but only annoyance. Certain nuisances which the health authorities would find it very difficult or impossible to deal with may thus be remedied by private action. This applies particularly to classes of nuisances (e.g., the noise nuisance) over which the power of the health authorities is weak or nil. Again, where stream pollution is in question, a property owner, by invoking the law of riparian rights, may secure results which public authorities, in the absence of explicit statutory provision, might not be able to obtain on account of inability to prove a public nuisance.

Further than the above sketch of remedies we cannot go, on account of the differences of legal procedure prescribed

in the various States, and the legal questions involved in the consideration of the different kinds of nuisances.

Administrative Control of Nuisances — NON-SANITARY[1] NUISANCES. — It has already been pointed out that the majority of nuisances pertain to public comfort and decency rather than to public health. Such are those which relate to the disposal of garbage and ordinary refuse such as old rags and papers, ashes and the like. Since a great deal of the routine attention of the average health department — following tradition — is spent on such matters, it would be desirable to have them referred so far as possible to other departments of the municipal government which may be made logically and directly responsible for them. The disposal of house refuse, dead animals, etc., is a matter of municipal engineering, like sewerage and street-cleaning, and should be handled by a special department of the local government. The inspection of plumbing (cf. page 422) might well be handled by the building or sewer department. Plumbing regulations are practically a set of trade construction rules which should be administered by practical plumbing inspectors and not by the specially trained sanitary inspectors whose services are required for duties directly affecting public health. The minor relation of sewer gas to health under ordinary conditions has been indicated in a previous chapter; even were that relation more important than is now thought by sanitarians, it would nevertheless be preferable to entrust the correctness of plumbing construction to those who make a specialty of construction rather than of public health. Such reassignments of responsibility need not deprive the health authorities of the power to enforce the proper disposal of excreta — which is a true public health function —

[1] This seems the best term to distinguish those nuisances which do not primarily or largely affect public *health*. The word "sanitary" is here used in its true significance of "relating to *health*," not in its popular sense referring largely to *cleanliness*.

or even of enforcing general municipal cleanliness when need be.

It has been suggested that the *police* might well handle, or assist in handling, many of the ordinary nuisances — such as those relating to cleanliness of yards, care of garbage and other refuse, etc. — which now take up a great deal of the routine attention of health departments. The police already deal with nuisances due to spitting, snow on sidewalks, weeds and the like, and with the relatively much greater number of patrolmen than sanitary inspectors it would appear a *prima facie* possibility to deal promptly and effectively with other kinds of nuisances, many of which could be remedied through simple oral notification. Offenders could be prosecuted by direct police procedure. Only conditions actually of direct danger to health would need to be referred to the health department, or those concerning which the patrolman has some doubt. The idea has been developed by Gunn,[1] who states that the majority of the police chiefs who were questioned granted the feasibility of such coöperation. The idea has a great deal to recommend it, and if adopted it would leave the health department freer to attack matters much more closely related to health, but, so far as the writer knows, it has not thus far been practically tried out *in extenso* anywhere in this country. In any case a closer degree of coöperation should be developed than now exists between the average health and police departments.

In many communities it is now the custom to have an annual "*clean-up*" day or week for the collection and disposal of the miscellaneous débris and refuse which has accumulated during the year. Health departments may coöperate in such activities if they will thus be saved a great deal of routine nuisance notification during the year.

[1] Gunn, "The Need for a More General Coöperation between Health and Police Departments," *Am. Jour. Pub. Health*, 1913, vol. III, no. 4, p. 318.

The amount of material from houses, cellars, vacant lots, etc., which may thus be removed in a thorough and well-advertised clean-up is large, often necessitating temporary provision of extra wagons and labor by the municipality. Opportunity should be taken for impressing the desirability of prompt removal of such materials during the year so that in future general clean-ups may not be necessary.

Inspections and Notifications. — 1. *Inspections.* — If regular house-to-house inspections are performed by the health department, as recommended in the last chapter, many nuisances will be discovered in that manner. Complaints will also be received and if there is any apparent ground for them, should be investigated even when unsigned, for the reason that unsigned complaints of conditions really needing attention are not infrequently made by persons who are apprehensive of having trouble with employer, landlord or neighbors if their identity is discovered. Although many complaints, perhaps the majority even, will be found to be based upon misapprehension or malice, it appears best that all which are not on their face unjustified should receive attention.

2. *Notices* in legal form should be served on the person or persons responsible, describing the nuisance, advising them to abate it "forthwith" or within a stated length of time, and reciting the penalty prescribed. A printed slip copy of the ordinance violated may be enclosed. The legal requirements for the service of notices should be ascertained from counsel, to be strictly followed in all cases. The inspector's notebook should show a record of each notice served.

In some cases, at the discretion of the health officer, a special letter may be written instead of a notice. In Montclair, N. J., a typewritten letter is sent out in each case, no printed form being used.

In dealing with minor nuisances *oral notification* by the inspector and the use of notice forms which may be filled

out by the inspector on the spot will be found useful. Such nuisances are numerous and would consume a great and unwarrantable amount of time and energy if office notices were made out in all cases.

3. *Reinspections* are made in due course and reported back to the office. Nuisance records should be reviewed in general once a week.

4. Legal *remedies* have been considered in a preceding section.

I. NUISANCES INVOLVED IN DISPOSAL OF WASTES

I. DISPOSAL OF EXCRETA

By far the most important class of nuisances from the public health standpoint are those involved in the disposal of human wastes. It is a first duty of every health department to insist upon the disposal of such a matter in such a way that the public health is safeguarded. Excreta should always be regarded as potentially infected; in Chapter I (under Epidemiology) has been pointed out the danger arising from improper disposal in a single case. Proper disposal means prompt removal — if possible by means of sewers — with safeguards against contact and insect infection and pollution of water supplies, to a point where the wastes are not a source of danger. This principle applies to the simplest privy and to the largest system of sewers and sewage treatment.

Sewage disposal in general involves two considerations: The prevention of nuisance to the senses, and prevention of infection. The former is too obvious to require discussion; we shall, therefore, devote our attention to the latter.

Where sewers exist, an ordinance should be adopted requiring the connection of all dwelling houses on sewered streets with those sewers and the installation of adequate

plumbing appliances (say within thirty or sixty days), followed by the immediate cleaning out and abolition of previously existing privy vaults and cesspools. Such an ordinance, persistently enforced, should do away practically entirely with the privy nuisance. Any privies which remain on unsewered streets should be of a sanitary type (see below).

Where sewers do not exist, as in rural and semi-rural districts, the methods of disposal of excreta should be strictly regulated. Soil pollution and the spread of infection from unsanitary privies through domestic animals, flies, etc., are inexcusable in any community. Privies and cesspools are an additional menace where domestic water supplies from wells exist in conjunction with them.

1. **Privies.** — The following are the chief *requirements* for the "sanitary privy":

1. It must be convenient and cleanly, as regards both use and cleaning. The ventilation should be adequate. Persons will not properly use nor properly care for an offensive, inconvenient privy.

2. There must be safeguards against danger of spreading infection. Stiles and Lumsden give the following desiderata under this head:

(*a*) "The excreta must not touch the ground; hence some kind of water-tight receptacle (box, pail, tub, barrel, tank or vault) for the excreta must be used under the seat.

(*b*) "Domesticated animals must not have access to the night soil; therefore, the privy should have a trapdoor in the back to exclude them.

(*c*) "Flies and other insects must not have access to the excreta; therefore, the entire privy must be made rigidly flyproof, or some substance must be used in the receptacle to protect the contents from insects."

3. The final disposal of the contents [frequently called "night soil," from the custom in some places of removing at night] must be safe.

4. The cost of construction and care must not be excessive.

Full and detailed directions for the construction and operation of sanitary privies may be obtained in the Government bulletins on the subject,[1] from which the following excerpts are taken.

Two types of sanitary privies are generally recognized, namely, the so-called "dry system" and the so-called "wet system." It will be noted that the above authors recommend a properly managed "wet system," of which a special form has been designed (see note at close of following quotation).

THE "DRY SYSTEM"

In the "dry system" privies dry earth, road dust, wood ashes or lime is kept in the privy, and is scattered on the excreta every time the privy is used.

The dry system, if properly managed, presents the following advantages:

(1) It decreases the offensiveness of the privy contents.

(2) It is cheap.

(3) It decreases the chance of spread of infection by insects.

(4) It is an easy system to manage.

The disadvantages of the dry system are the following:

(1) It is very difficult to make a dry privy rigidly flyproof, hence flies usually do have more or less access to the excreta, on which they feed and on which they lay their eggs.

(2) Its efficiency depends upon the careful and faithful coöperation of all persons (including children) who use the privy, and experience shows that such coöperation cannot be relied upon.

(3) It increases the amount of material to be removed; hence it increases the labor and frequency of necessary cleaning.

(4) Experience shows that it is exceptional that the excrement is properly covered with dry earth or lime; hence the system is not so efficient as is popularly supposed.

[1] Farmers' Bulletin 463, U. S. Dept. of Agriculture: "The Sanitary Privy" (by Stiles and Lumsden, 1911), and Public Health Bulletin No. 37, U. S. Pub. Health Service: "The Sanitary Privy: Its Purpose and Construction" (Stiles, 1910). Special attention to the subject has also been paid by the southern state health departments, from which information and plans may be obtained.

(5) Neither dry earth nor lime, in practical usage, can be relied upon to destroy all disease germs which may be in the excreta; hence their use is likely to give rise to a false sense of security in the public mind.

(6) If the dejecta at the time of burial contain fly grubs these larvæ may crawl through the earth to the surface, where they can complete their development into adult flies and spread infection from the buried night soil.

Privies of the "dry system" should not be marked more than 75 points on a scale of 100.

THE "WET SYSTEM"

In the "wet-system" privies some fluid is used in the receptacle either (1) to disinfect the excreta, or (2) to act as an insect repellent, or (3) to increase the destruction of disease germs in the excreta by natural fermentation.

The advantages of the "wet system" are:

(1) It decreases the offensiveness of the privy contents.

(2) It is cheap.

(3) It greatly decreases the chances of spread of infection by flies because they cannot breed in the excreta; hence rigid fly screening is not so necessary.

(4) It kills or renders harmless a considerable proportion of certain infections contained in the excreta.

(5) Its efficiency does not depend upon the intelligence or coöperation of all persons using it.

The disadvantages of the "wet system" are:

(1) It is more difficult to keep clean than the "dry system," because of the danger of soiling the floor when the receptacle is emptied.

(2) Unless the receptacle is very deep there is likely to be more or less splashing.

(3) The labor and frequency of cleaning are about the same as in the case of the "dry system."

If the wet system is used it is best to fill the receptacle about one-fourth full of water, on the surface of which a cup of petroleum is poured. The petroleum acts as an insect repellent.

Two sets of receptacles should be provided. While one set is being used under the seat, the other set is covered and permitted to stand so as to lengthen the period of fermentation.[1]

[1] Farmers' Bull. 463, pp. 15–17. The L. R. S. (Lumsden, Roberts and Stiles) wet-system privy is fully described in this bulletin.

The above remarks relate to properly constructed outhouses, concerning which the following general directions apply.[1]

HOW TO BUILD AND CARE FOR A PRIVY

The following are the essential features: There is (A) a closed portion (box) under the seat for the reception (in a receptacle) and safeguarding of the excreta; (B) a room for the occupant; and (C) there is proper ventilation.

A. The receptacle consists practically of a box, with a top represented by the *seat*, with a *floor* which is a continuation of the floor of the room, with a *front* extending from the seat to the floor, with a *hinged back* which should close tightly, and with two *sides* continuous with the sides of the room and provided with wire screened ventilators, the upper margin of which is just under the level of the seat. The seat should have one or more holes according to the size of the privy desired, and each hole should have a *hinged lid* which lifts up toward the back of the room; there should be a piece of wood nailed across the back, on the inside of the room, so as to prevent the lids from being lifted sufficiently to fall backward and so as to make them fall forward of their own accord as soon as the person rises. In this box there should be one or more water-tight tubs, half barrels, pails or galvanized cans, corresponding to the number of holes in the seat. This receptacle should be high enough to reach nearly to the seat, or, better still, so as to fit snugly against the seat, in order to protect the floor against soiling, and sufficiently deep to prevent splashing the person on the seat; it should be held in place by cleats nailed to the floor in such a way that the tub will always be properly centered. The back should be kept closed.

B. The room should be water-tight and should be provided in front with a good, tightly fitting *door*. The darker this room can be made the fewer flies will enter. The *roof* may have a single slant or a double slant, but while the double slant is somewhat more sightly, the single slant is less expensive on first cost. The room should be provided with two or three wire-screened ventilators, as near the roof as possible.

C. The ventilators are very important additions to the privy, as they permit a free circulation of air and thus not only reduce the odor but make the outhouse cooler. These ventilators should be copper wire screened in order to keep out flies and other insects. There should be at least 4 (better 5) ventilators, arranged as follows: One each side of the box; one each side the room near the roof; and a fifth ventilator, over the door, in front, is advisable.

[1] For further details see the Bulletins already referred to.

Latticework, flowers and vines. — At best, the privy is not an attractive addition to the yard. It is possible, however, to reduce its unattractiveness by surrounding it with a latticework on which are trained vines or flowers. This plan, which adds but little to the expense, renders the building much less unsightly and much more private.

Disinfectant. — It is only in comparatively recent years that the privy has been thought worthy of scientific study, and not unnaturally there is some difference of opinion at present as to the best plan to follow in regard to disinfectants.

[" Dry system":]

(*a*) *Top soil.* — Some persons prefer to keep a box or a barrel of top soil, sand or ashes in the room and to recommend that each time the privy is used the excreta be covered with a shoveful of the dirt. While this has the advantage of simplicity, it has the disadvantage of favoring carelessness, as people so commonly (in fact, as a rule) fail to cover the excreta; further, in order to have the best results, it is necessary to cover the discharges very completely; finally, at best, our knowledge as to how long certain germs and spores will live under these conditions is very unsatisfactory.

(*b*) *Lime.* — Some persons prefer to have a box of lime in the room and to cover the excreta with this material. Against this system there is the objection that the lime is not used with sufficient frequency or liberality to keep insects away, as is shown by the fact that flies carry the lime to the house and deposit it on the food.

[" Wet system ":]

(*c*) *Water and oil.* — A very cheap and simple method is to pour into the tub about 2 or 3 inches of water; this plan gives the excreta a chance to ferment and liquefy so that the disease germs may be more easily destroyed. If this plan is followed a cup of oil (kerosene will answer) should be poured on the water in order to repel insects.

(*d*) *Cresol.* — Some persons favor the use of a 5 per cent crude carbolic acid in the tub, but probably the compound solution of cresol (U. S. P.) will be found equally or more satisfactory if used in a strength of 1 part of this solution to 19 parts of water.

If a disinfectant is used the family should be warned to keep the reserve supply in a place that is not accessible to the children, otherwise accidents may result.

Cleaning the Receptacle. — The frequency of cleaning the receptacle depends upon (*a*) the size of the tub, (*b*) the number of persons using the privy and (*c*) the weather. In general, it is best to clean it about once a week in winter and twice a week in summer.

An excellent plan is to have a double set of pails or tubs for each privy. Suppose the outhouse is to be cleaned every Saturday: Then pail No. 1 is taken out (say January 1), covered and set aside until the following Saturday; pail No. 2 is placed in the box for use; on

January 8 pail No. 1 is emptied and put back in the box for use while pail No. 2 is taken out, covered and set aside for a week (namely, until January 15); and so on throughout the year. The object of this plan is to give an extra long time for the germs to be killed by fermentation or by the action of the disinfectant before the pail is emptied.

Each time that the receptacle is emptied, it is best to sprinkle into it a layer of top soil about a quarter to half an inch deep before putting it back into the box.

Disposal of the Excreta. — For the present, until certain very thorough investigations are made in regard to the length of time that the eggs of parasites and the spores of certain other germs may live under various plans, it is undoubtedly best to burn or boil all excreta; where this is not feasible, it is best to bury all human discharges at least 300 feet away and down hill from any water supply (as the well, spring, etc.).

Many farmers insist upon using the fresh night soil as fertilizer. In warm climates this is attended with considerable danger, and if it is so utilized, it should never be used upon any field upon which vegetables are grown which are eaten uncooked; further, it should be promptly plowed under.

In our present lack of knowledge as to the length of time that various germs (as spores of the ameba which produce dysentery, various eggs, etc.) *may live, the use of fresh, unboiled night soil as a fertilizer is false economy which may result in loss of human life. This is especially true in warm climates.*[1]

It is estimated that the cost of materials for a sanitary type of privy on the above principles will be from $5 to $10, according to locality, to which must be added carpenter or home labor.

Multiple privies on the above principles may be constructed for schools, hotels, etc.

Every board of health should have an ordinance requiring privies (where necessary) to be constructed and cared for, not necessarily according to a fixed plan, but at least according to sanitary principles and subject to the approval of the health authorities.[2]

[1] Pub. Health Bull. No. 37, pp. 8–11.

[2] The possible development of patent sanitary closets is worthy of note. Such a closet, designed for use anywhere in the house, is manufactured by the West Disinfecting Co., 12 East 42nd St., New York City. Such devices must be judged according to their cost and their merit as demonstrated in practical use.

Disposal of Night Soil. — Special attention should be paid to the disposal of night soil, on which some remark is made in the quotation above. Since the ideal method of burning or boiling is impracticable to enforce generally, reliance must usually be placed upon proper burial (not less than two feet deep) in a safe place, preferably with the use of a disinfectant (chloride of lime, etc.). It must be remembered, however, that this is not an ideal method, for disease germs may later come to the surface, any fly grubs present are not killed but may come to the top through as much as six feet of sand, and there is the possibility of contaminating water supplies, especially in a limestone region. The great danger in the use of night soil as fertilizer (mixed or unmixed with manure) is referred to above. Owing to the impossibility of knowing which persons in a community are excreting disease germs, all excreta (stools and urine) must be regarded as a virulent poison to be disposed of accordingly.[1] Provision should also be made for sufficiently frequent removal of contents to prevent danger of overflow. In Asheville, N. C., a city having sanitary privies and municipal removal, a maximum period of fifteen days is prescribed. The period may, however, vary somewhat, according to circumstances.

Temporary Privies. — In connection with construction work on new houses, etc., street work and other works where laborers are employed, temporary privies should be required and the commission of nuisances be forbidden. Coöperation may be established with the building inspection department, so as to obtain notice of constructions to be started. Such privies should be constructed on approved lines, a permit from the health department being required. The foreman or other person in charge should be held strictly responsible for their construction and care. It should be prescribed that there be a proper watertight receptacle and that the contents be kept constantly

[1] For further details see Farmers' Bulletin 463, pp. 30–32.

covered with unslaked lime, chloride of lime, water with a film of kerosene (see directions for "wet system," above) or other satisfactory substance, and that the contents be sufficiently frequently removed and disposed of in accordance with the sanitary ordinances, the receptacle being finally cleaned out and disinfected as soon as there is no longer any necessity for use.

Similar precautions should be taken in regard to picnic grounds and other places where temporary gatherings of people take place. Such places, if regularly used, should be provided with permanent sanitary privies.

Privy-cleaning Service. — Granted that the health department has an ordinance covering completely the subject of privies and disposal of excreta, the question of systems of removal of night soil arises. In many communities having privies such removal is performed by private scavengers, who should be strictly licensed, subject to the approval of the health authority regarding their methods of collection and disposal. The following remarks, applying both to towns and to rural districts, are taken from Stiles.[1]

Since, from a sanitary point of view, the privy is a public structure, in that it influences public health, it seems wisest to have city and town ordinances which provide for a licensing of all privies, the license being fixed at a sum which will enable the city or town to provide the receptacle (tub, pail, etc.), the disinfectant and the service for cleaning. The expense involved will vary according to local conditions, such as cost of labor and density of population. If the "chain gang" can be utilized for cleaning, the expense for labor is reduced.

The importance of taking the responsibility for the care of the privy out of the hands of the family is evident when one considers that one careless family in ten or in a hundred might be a menace to all. Quite generally the removal of garbage and of ashes is recognized as a function of the city or town in all better organized communities, and the idea is constantly spreading that this service should extend to a removal of the night soil also.

In correspondence with certain cotton mills estimates for privy cleaning (once a week) vary from about 20 to 25 cents per privy per

[1] Pub. Health Bull. No. 37, pp. 15, 16.

month. A privy tax of \$3.50 to \$5 per privy per year ought to give satisfactory service, including receptacle, but the exact amount of the tax must be determined by experience in each locality.

It is probably the exception that an economical public privy-cleaning service can be carried out in the open country, on account of the distances between the houses. To meet the difficulties involved, several suggestions may be considered, according to conditions: A county privy tax can be levied, the county can furnish the pail and the disinfectant, and (1) one member of each family or of several neighboring families hired to clean the privy regularly; or (2) the landlord can be held responsible for the cleaning of all privies of his tenants, receiving from the county a certain sum for the service; or (3) " trusties " from prisons might possibly be utilized in some districts not too sparsely settled; or (4) a portion of the county privy tax might perhaps be apportioned by school districts and be distributed as prizes among the school boys who keep their family privy in best condition; or (5) each head of family might be held responsible for any soil pollution that may occur on his premises and be fined therefor.

Undoubtedly the problem of the privy cleaning in the open country is much more difficult than in cities, villages and towns, and in the last instance involves a general education of the rising generation of school children, more particularly of the girls (the future housekeepers), in respect to the dangers of soil pollution.

2. **Cesspools and Domestic Sewage Disposal Systems.** — The construction and care of cesspools should be supervised in the same way as that of privies. Two types of cesspool are to be recognized: (1) the tight cesspool, and (2) the leaching cesspool. Each, according to circumstances, has its value. Where there is no danger of the pollution of wells, etc., the leaching type may be permitted and with right soil conditions may prove a highly effective and commendable method of sewage disposal. In this case the soil acts as a natural filter. Sandy soils are best, while clay and limestone are to be distrusted. In regard to the protection of wells, etc., in the vicinity, it must be remembered that intestinal organisms may still be carried somewhat beyond the zone in which oxidation of organic matters takes place.

Where it is necessary for the prevention of soil pollution to use a tight cesspool, a plan should be submitted and a

permit be required before it is begun and again before it is put in use, so that the health authorities may satisfy themselves that the construction is water-tight and sufficiently substantial to remain so. With this type of cesspool cleaning out must be sufficiently frequent, and the contents must be disposed of under the same regulations that apply to privies.

Cesspools of either type should be so covered as to prevent the access of flies and mosquitoes.

Domestic sewage disposal systems for rural and semi-rural districts should be constructed on scientific plans adapted to local conditions and under the supervision of the health authorities, who should require a permit for the beginning of such work and another final permit when the system is completed and before it is put in use. Suitable plans and advice may be obtained from competent sanitary engineers and from the engineering divisions of state health departments.[1]

The menace to health from the discharging of undisinfected sewage and sewage disposal effluents into water-courses which may be used as water supplies is obvious and need not be dwelt upon here; nor can the subject of municipal sewage disposal be discussed.[2] Methods of determining when sewage pollution by leaching and otherwise is taking place have already been mentioned (Chap. IV).

II. DISPOSAL OF OTHER WASTES

We now come to a class of nuisances having much less bearing upon public health than those of the class just mentioned (in fact in many cases no bearing at all), but which consume much of the routine attention of health

[1] Cf. Bashore, "Sanitation of a Country House"; Gerhard, "The Disposal of Household Wastes"; and Gerhard, "The Sanitation, Water Supply, and Sewage Disposal of Country Houses."

[2] See Rosenau, "Preventive Medicine and Hygiene," 1913, sec. VII (by G. C. Whipple).

departments. These relate chiefly to the promotion of general municipal cleanliness, the influence of which on public health is largely indirect.

Municipal refuse is specified by Hering[1] as follows: garbage, dead animals, night soil (which we except in our remarks under this section), manure, street sweepings, ashes and rubbish.

The permissible *methods* of disposing of these various classes (omitting night soil), with the several end-results or products, are summarized by the same authority[2] as follows:

Refuse	Incineration	Reduction	Burial or plowing into ground	Dumping	Feeding
Garbage.........	Steam and ashes	Grease and fertilizer	Decomposition and fertilizer	....	Food for pigs
Dead animals...	ditto	ditto	ditto	....	
Manure[2]........	ditto	....	ditto	Land making[1]	
Street sweepings.	ditto	....	ditto	ditto[1]	
Ashes...........	Steam and clinker	....	....	ditto[1]	
Rubbish........	Steam and ashes with or without prior picking	....	....	ditto[1]	

[1] Not always advisable.

[2] The disposal of manure by rotting has also been proposed, the claim being that if the manure is stacked in suitable quantities and places the resulting fermentation will result in a sufficiently high temperature to kill eggs and maggots. The author has, however, no definite information as to the effectiveness of this process. — J. S. M.

Where incineration is adopted, it will be seen it can be applied to all classes of refuse, and night soil can also be most safely disposed of by this method.

The question as to what method or methods shall be adopted by any community involves consideration of local

[1] Hering, "Disposal of City Refuse," *Trans. X V Internat. Congress on Hyg. and Demogr.*, 1912, vol. IV, pt. II, p. 398.

[2] *Loc. cit.*

conditions and costs, and since it relates primarily to sanitary or municipal engineering, need not be taken up here.[1] The *supervision* of sanitary authorities over refuse may be considered under two heads.

1. Prevention of Unnecessary Nuisance. — This requires that the methods of householders and collectors of refuse be careful and cleanly, that garbage and offal cans be water-tight and properly covered (to prevent odor and the access of flies and domestic animals), that they be taken in as soon as emptied, that (where the separation system is employed) garbage be kept separate from other refuse, that dead animals be removed promptly, that removal of all refuse be sufficiently frequent, and the like. Also that final methods of disposal be proper, forbidding garbage dumps[2] and the filling-in of land with garbage, etc. Private scavengers should be licensed so as to insure proper control of their methods. *Refuse collection and disposal* is properly a function of the municipal government where it can be economically so managed. It should, however, be assigned to some department other than the health department — perhaps most appropriately to the street-cleaning authorities.

2. Prevention of Breeding of Flies, Rats and Other Vermin. — The care of stable manure has a special bearing on the suppression of flies; that of garbage, on the reduction of rats. Fly prevention will be considered in detail in a subsequent section.

Beyond these latter considerations the care of refuse has practically no bearing on public health, but is rather a matter of civic cleanliness.

Here, in general, may be included all nuisances relating

[1] See Rosenau, "Preventive Medicine and Hygiene," 1913, sec. VIII (by G. C. Whipple); Papers and Rpts. of Committee on Refuse Collection and Disposal, in *Am. Jour. Pub. Health.*

[2] Cf. Terry, "The Public Dump and the Public Health," *Am. Jour. Pub. Health,* 1913, vol. III, no. 4, p. 338.

to cleanliness of dwellings, yards, lots, alleys, streets, etc., which need not be specified. In many communities the alley constitutes a special problem of municipal cleanliness; wherever possible alleys should be taken over and cleaned by the municipal street-cleaning department. We need scarcely mention the disposal of dead bodies, of which the bearing on health is, under normal conditions, very slight. Cemeteries were formerly thought dangerous to public health and were stringently regulated, but now it is known that the ordinary cemetery is negligible from the health standpoint, except as underground water supplies may possibly be contaminated by it.

II. NUISANCES DUE TO INSECTS AND VERMIN

I. FLY SUPPRESSION

The arguments against the fly as a vehicle of disease which were indicated in Chapters I and II indicate fly suppression to be a duty of health authorities. It was shown that both the house fly and the stable fly may convey infection (typhoid fever and other diseases) *mechanically* (on feet and proboscis), and the stable fly through its *bite* (poliomyelitis, anthrax, etc.).

The epithet "filth fly" implies that the disposal of certain kinds of refuse — notably stable manure — quite aside from the question of nuisance in the popular sense of the word, has a public health bearing in the breeding and attraction of flies. The epithet applies particularly to the fly as a conveyer of infection from privy vaults.

The importance of the problem in any given case depends upon (1) the facilities for fly-breeding (especially in stable manure), (2) the length and warmth of the summer season, and (3) the opportunities for infection (in typhoid fever, etc., exposed infectious material; in poliomyelitis, etc., infected persons). Favorable conditions for fly transmission of disease may be found to a greater or lesser extent

in all parts of the country. As regards typhoid fever and other intestinal diseases, conditions require attention in unsewered or partly sewered communities, especially in the South, having the combination of flies and unprotected privy vaults. It is unfortunate that, except in certain instances, the data regarding the transmission of disease by flies are indefinite. (Cf. pages 190, 209.)

Where and How Flies Breed. — The vast majority — in many communities practically all — of common houseflies breed in horse manure, the remainder in decaying organic matter of various kinds, as human excrement, animal carcasses, garbage and the like. The stable fly (which has a predilection for biting horses and cattle, though it also bites persons) also breeds in horse manure, though more frequently in fermenting heaps of grass, cow-dung, brewer's refuse ("spent hops"), etc. Flies in the course of their life history pass through four stages: (1) egg, (2) larva or maggot, (3) pupa, or grub, and (4) adult insect. The complete development of the house fly takes, under favorable circumstances, about ten days; that of the stable fly is slower, taking nearly a month. The larva (white) and the pupa in its case (brown) may be readily seen with the naked eye; the eggs (white) are somewhat difficult to distinguish without the aid of a magnifying glass.

As to the prolificness of the house fly, Howard found that 120 eggs are laid by a single female (more have been noted), and that a generation is produced every ten days at the summer temperatures of Washington. This would mean twelve generations in a summer, with the possibility of countless millions from a single fly during a single season. Even did only a small percentage survive, the rapidity of propagation is evident. Two lessons may be gathered from this: (1) that the time to begin fly-suppressive measures is the early spring, and (2) that if breeding places are available a very few flies can produce a very great crop.

Measures Against Flies. — We shall discuss first and chiefly the care of stable manure (in which ninety per cent or more of flies breed), but similar remarks apply also to other refuse in which breeding may take place.

1. Removal and Disposal of Manure. — The frequent and regular removal of stable manure is the only thoroughly practicable general measure known at the present time. To prevent flies from laying their eggs in stable manure is practically impossible, for this material becomes fly-blown immediately it is excreted; but if it be placed promptly in tight bins, barrels or pits and removed regularly once a week during the fly season (so as to allow a margin under the ten days necessary for the eggs to hatch), fly-breeding in manure within the city limits can be entirely eliminated.[1] It is advisable that manure be removed by the municipal authorities in towns as other kinds of refuse are removed. Private collections are likely to be irregular for the reason that farmers do not care to remove manure during the busy summer months, when there is less use for it as fertilizer, yet this is just the time when the public health demands that it be frequently moved. Under municipal collection manure might be stored and sold at the times when in demand, and moderate fees for removal would make up the expense.[2]

[1] From the health department of a southern city (Asheville, N. C.) we have the following statement: "The proper disposal of manure, which we know to be the main breeding place of the fly, leads to many arguments. Many people wish to keep the manure for fertilizing purposes, and think that by placing it under the surface that they have gotten rid of the fly problem. Again, if the manure bin is screened a false sense of security is established which is sure to throw discredit on the fly work later in the summer. All manure that goes into the bin is sure to be infected with fly eggs, and as the young flies just leaving the chrysalis are perfectly able to crowd through the meshes of the screen, the screening is of no avail. *Our conclusion, therefore, is that the manure bin should be constructed with the single idea of being thoroughly cleaned out, and it should be cleaned out not less than once a week.*"

[2] See Hall, "Disposal of Manure," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 1, p. 38.

Removal, of course, does not result in absolute prevention of breeding, but simply in the transportation of the fly-breeding manure to some more or less distant place (usually to the country for fertilizer). There the eggs already present (as well as those later deposited) will hatch out even if the manure is buried or plowed under ground (fly grubs have been known to emerge through six feet of sandy soil). Such methods protect the towns which enforce removal of manure, but the general prevention of breeding, including the country districts, is a much more difficult problem and one which has not yet been practically solved.

For methods of disposal of manure see page 459.

2. Ground-Proofing. — A certain amount of breeding may take place in the soil under and around stables, in old stray, decayed urine-soaked boards, etc.; hence the flooring of stables should be watertight and well drained and general cleanliness and good repair should be observed.

3. Chemical Treatment. — As direct measures for killing the larvæ and insects in the course of their development, various chemical substances have been employed, such as Paris green (recommended by U. S. Public Health Service) and copperas solutions, kerosene and other insecticides.[1]

Regular treatment cannot, of course, be secured unless frequent inspections are made to apply the insecticide or

[1] From Asheville, N. C., where special attention has been devoted to the fly problem, comes the following recommendation: "Some experiments carried out last summer [1912] have convinced me that where manure is not taken out of the city limits promptly the best larvacide is Paris green, used as it is on potato plants, about one ounce to ten gallons of water. Where this is conscientiously sprinkled on fresh manure the larva does not grow. It is so cheap that there is no excuse on that point for not using it, and as an economic proposition I calculate that it saves about one-third of the fertilizing value of the manure from being destroyed by the maggots." (L. M. McCormick, Inspector.)

to see that it is being properly applied. The method certainly merits attention where frequent removal is impracticable, as, for example, in rural districts.

In this connection the treatment of manure in specially constructed *maggot traps* offers considerable possibilities, though the method has not as yet been entirely worked out.[1]

4. Care of Refuse other than Manure. — Since accumulations of garbage, offal and the like are not usually permitted to remain as long as those of stable manure, the amount of fly-breeding due to them is comparatively small. Such refuse should, however, be kept covered and should be removed regularly at frequent intervals. The prevention of obvious nuisance in the popular sense fortunately requires this. Markets should receive special attention as regards disposal of wastes. Fly-breeding may readily take place in garbage dumps, which also tend to support a population of rats. Such dumps should be prohibited on these specific grounds as well as in their character as a general public nuisance.

5. Screening of privies, sick-rooms, kitchens and other rooms in dwelling houses, restaurants, milk-rooms and the like is a useful means of guarding against flies which cannot practically be eliminated by the foregoing fundamental measures. Citizens may be advised to screen dwelling houses in order to protect foods, baby's bottle, etc. The screening of places where food for public consumption is handled or otherwise exposed may be required by ordinance. Cases of communicable disease may be required to be screened and the flies within destroyed; even the poorest families can usually afford mosquito netting.

The most important measure of this class is the fly-proofing of privies (see under Privies).

[1] Levy and Tuck, "The Maggot Trap — A New Weapon in Our Warfare Against the Typhoid Fly," *Am. Jour. Pub. Health*, 1913, vol. III, no. 7, p. 657; Levy, "Modern Methods of Fighting the House-fly," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 5, p. 439.

The health officer of a southern city where privies and flies are numerous reports as follows:

> As a result, I believe, of the screening of the privies and sick rooms, the number of cases of typhoid reported to the Health Department during 1911 was 148 against 329 for 1910, the deaths for the same years being 40 against 62. . . . Not only did this reduction occur, but we found that the distribution of the cases as to privy or sewer districts was practically reversed in 1911 from that of 1910, showing no disproportion of cases in the privy districts.[1]

Even if only a part of the above improvement were finally proved to be directly due to screening, it would still be a result of special significance to communities having the unfortunate combination of privies and flies.

In considering the *use and value* of screening we must bear in mind the various circumstances under which it may be applied. In urban districts, where population is thick and stables and other possible sources of flies few, the fundamental measure of fly elimination should certainly be applied. In country districts, on the other hand, where breeding may go on to a greater extent and is relatively difficult to prevent, the fly-proofing of privies and the use of screens for milk-houses and dwellings are to be considered as a possible alternative.

Popular education, as to the manner of breeding of the fly and its rôle in disease conveyance, is a useful auxiliary measure, but cannot take the place of vigorous enforcement of anti-fly ordinances. In Asheville, N. C., an effective exhibit illustrating the breeding of the fly is used, and the inspectors carry small specimens showing the stages of development of the insect.

Ordinances should be adopted covering the points above mentioned and declaring the accumulation of manure,

[1] Terry (Health Officer, Jacksonville, Fla.), "Fly-borne Typhoid and Its Control in Jacksonville," *Southern Med. Jour.*, 1913, vol. VI, no. 6, p. 355.

garbage or other substance in which fly larvæ breed to be a nuisance subject to penalty for each day maintained. The orders adopted by the District of Columbia have been justly praised.[1] It is desirable to require licenses for stables in order to impress stable proprietors with their responsibility and to obtain compliance with stable and manure regulations.

Campaigns for the destruction of flies by means of traps, "swatting," poisons, fly paper, etc., are more remarkable for spectacularity than for efficacy. It is evident, in the first place, that trapping and the like, even when most efficient, do away with but a comparatively small proportion of the adult fly population, particularly if it is being constantly added to by uncontrolled breeding places. Then, when it is considered how (as already explained) a few flies are capable of breeding a large crop, in connection with the fact that many flies must escape trapping, the futility of such measures, instead of the prevention of actual breeding, is evident. Fly "swatting" should, therefore, not be permitted to distract attention from the fundamental problem.

Traps (preferably of the large size, about two feet high and fifteen inches in diameter as manufactured) are more useful for gauging the prevalence of flies and the success of anti-fly measures than for reduction of the numbers of the insects. Flies caught in large numbers need not be counted, but may be measured on a basis of 13,000 to the quart.

The solution of the problem in general hinges, in towns, chiefly upon the proper construction of stables and the removal or treatment of stable manure. In the rural districts, on the other hand, stables may be poorly constructed, the manure frequently cannot be conveniently removed to a distance, it is difficult or impossible to compel proper treatment of manure and frequent inspections perhaps cannot well be made. In the latter case the fly-proofing of

[1] Rosenau, "Preventive Medicine and Hygiene," 1913, p. 231.

privies and the use of screens may perhaps at present be relatively more practicable.

REFERENCES

U. S. Dept. of Agriculture, Farmers' Bulletins 459 (House Flies) and 540 (The Stable Fly) (apply to Supt. of Documents, Washington, D.C.).

Howard, "The House Fly — Disease Carrier; An Account of Its Dangerous Activities and the Means of Destroying It," Stokes Co., New York, 1912.

Ross, "The Reduction of Domestic Flies," Lippincott, Phila., 1913.

Hewitt, "House Flies and How They Spread Disease," 1912.

Doane, "Insects and Disease."

Rosenau, "Preventive Medicine and Hygiene," 1913, p. 223 ff.

Material on anti-fly campaigns is published by the American Civic Assn., 913 Union Trust Bldg., Washington, D. C.

In addition to papers cited see Terry, "Extermination of the House Fly in Cities, Its Necessity and Possibility," *Am. Jour. Pub. Health*, 1912, vol. II, no. 1, p. 14.

II. MOSQUITO SUPPRESSION

Nature and Control of Work. — The mosquito problem may affect *public health, or public comfort*, or both. Where mosquito-borne disease — malaria or yellow fever [1] — exists or threatens, mosquito suppression becomes an obvious duty of the health authorities; in communities where these diseases do not exist the matter is simply one of public comfort and property values. For this reason, and because thorough work in mosquito-ridden localities requires extensive operations of a special nature, it is frequently desirable that the work be performed on a large scale — say county-wide — by special authorities.[2] When,

[1] For discussion of the relations of mosquitoes to these diseases see p. 207 ff.

[2] In New Jersey long experience of the inability or unwillingness of boards of health to cope with the mosquito problem has led to the establishment, by a law of 1912, of County Mosquito Extermination Commissions, which not only perform inspections but also carry out much of the work — such as elimination of marshes — necessary to a thorough mosquito reduction campaign. The results show that such

however, the duty rests with the health authorities they should if possible carry it out thoroughly, remembering, however, that sufficient work and money must be applied if material results are to be expected, and that there may be other public health demands more pressing.

The problem of mosquito reduction involves far more labor and expense than the average citizen or health officer supposes. For adequate inspection the ordinary board of health staff of inspectors must practically be doubled, and a great deal of extra duty is thrown upon the health officer and office. Besides, it is usually necessary to employ special labor for ditching, etc. Furthermore, unless the work is done thoroughly, very little result may be evident and the work will be discredited.

The Mosquito. — Besides the disease-bearing species, there are others, *Culex* — a presumably harmless insect — being the commonest. All mosquitoes breed in *standing water and nowhere else* — some in salt and some in fresh water. The malaria and yellow fever mosquitoes breed only in *fresh water.*

The *life history of the mosquito* embraces four stages: (1) egg, (2) larva, (3) pupa and (4) adult. The eggs are deposited on the surface of stagnant water, particularly that which is rich in organic matter, even if distinctly foul. The egg hatches out into a larva (or "wiggler," such as is fre-

a plan might well be adopted wherever a great amount of inspection and labor is required. The work may thus be specialized under experts and all communities derive equal benefit. Under the plan of control by local boards of health a community which carries on an effective campaign may still suffer from the inaction of its neighbors. (Information on the work in New Jersey may be obtained from the State Entomologist, New Brunswick, N. J.)

A plan for giving power to local health authorities to abate breeding places and for organizing mosquito reduction work on a state-wide scale, under the Director of the State Experiment Station, has been proposed in Connecticut. (Report on Mosquito Control, Civic Federation of New Haven, 1913 (Chamber of Commerce Bldg., New Haven, Conn.)

quently seen in rain barrels), and the latter into the shorter but much larger-headed pupa. All of these stages are passed in the water and finally the adult mosquito bursts from the pupa and flies away. The whole cycle, from egg to adult insect, takes practically from nine days to three weeks, depending upon temperature and food supplies. In warm weather and with abundant organic matter present, the complete development will take place in a minimum length of time.

It is a popular belief that mosquitoes breed without water in grass, bushes, weeds and the like. This is untrue, for a continuous existence in stagnant, or at least standing, water is necessary for development. It is, however, true that such growths shelter the adult mosquitoes (which die if exposed to the sun and deprived of moisture), and also keep them from being carried away by wind; hence the cutting down of tall grass, weeds, etc., assists to that extent.

The mosquito survives from one summer season to the next by the hibernation of a few insects or eggs.[1]

Discrimination may easily be made between the fresh-water mosquitoes (e.g., *Culex pungens*, *Anopheles* (malarial), *Aëdes* (yellow fever)) and the salt-water species (of which one of the chief is the *Culex sollicitans* of the Atlantic Coast marshes). The latter may be distinguished by thin striped

[1] Many mosquitoes hibernate in the cellars or basements of dwellings and the proposal has been made in some quarters to kill all such mosquitoes before the breeding season begins. To materially reduce the numbers by this process would be expensive and of doubtful value. The labor and money might much better be applied to abolition of breeding places as hereinafter described. For, if such abolition be effective the hibernated mosquitoes would find no place to deposit eggs, while if it be not effective, even a very few hibernated mosquitoes (laying several hundred eggs apiece) would be sufficient to start a big season's crop.

However, for the purpose of killing adult mosquitoes in dwellings an insecticide may be used — e.g., sulphur, pyrethrum powder or Mim's culicide. (See pp. 588, 592.)

legs and the bar across the proboscis of the female, as well as by their antipathy to entering dwelling houses. The Anopheles (malarial) mosquito may be recognized by its attitude when resting or biting, in which the body and proboscis form an acute angle with the surface on which the insect rests; the body of the Culex, on the contrary, remains practically parallel with the resting surface.

Breeding-Places. — The great and fundamental means of mosquito reduction is the elimination of accumulations of stagnant water, even in small quantities. A neglected tin can holding water may breed hundreds of mosquitoes during a season. The following are examples of the breeding places of Culex and Anopheles most frequently found in practice:

Swamps and marshes, pools, rain puddles, ditches, puddles of standing water along watercourses, the margins of ponds, etc.

Brook beds (in dry weather).

Cesspools and liquid contents of privy vaults.

Vats and barrels in manufacturing plants, gardens and greenhouses.

The water surrounding commercial gastanks, etc.

Sewer catchbasins, manhole catchbuckets, wells (occasionally in hot weather), rain barrels, cisterns, tubs, cans, pails, watering-pots and other receptacles left standing so as to harbor water (such receptacles are ready breeders unless tightly covered or screened).

Various places, frequently out-of-the-way, such as the crotches of trees, depressions in roof gutters and the like, in fact, any place where water may stand for ten days or more in warm or moderately warm weather.

The breeding habits of the Aëdes (yellow fever mosquito) differ from those of the above genera. The breeding-places of Culex and Anopheles are much more widely distributed and require more labor to detect and abolish than those of Aëdes, which is practically limited to artificial containers in the vicinity of human habitations. The adult Aëdes also tend to remain comparatively close to their birthplace.

Administrative measures for reduction apply, on the one hand, to the large marsh areas, where engineering skill is

required and which should be handled by state or county authority; and, on the other hand, to the numerous breeding-places in the vicinity of dwellings which may, if need be, be dealt with by local inspections and action.

1. Permanent. — Whenever possible, more or less permanent measures, even if high in first cost, should be applied.

First, all cisterns, rain barrels, cesspools and other containers which cannot be abolished must be perfectly covered or screened. Care must be taken that the screen is sufficiently fine-meshed (at least twenty strands to the inch), as not all of the screens on the market are perfectly mosquito-proof. All such coverings should be frequently reinspected to ensure that they remain perfectly tight.

The best way to treat small receptacles is, if possible, to break or pierce them so that they cannot act as containers of water, otherwise to turn them upside down.

Secondly, swampy land, pools, ditches and the like should be drained or filled. When ditches are used for draining, they must be cleaned and graded from time to time. Where such work is extensive, it is just that this expense be defrayed by public funds, except in so far as the value of the property is increased.

Ponds and pools which contain fish do not commonly breed mosquitoes, for the larvæ are devoured by the fish. Gold-fish are especially effective in this respect; hence pools, fountains and the like which are kept for decorative or useful purposes may be kept mosquito-free by stocking with a few of these fish. It may sometimes be more feasible to flood a swampy area and introduce fish than to drain or fill it. A caution is required, however, in relation to the borders of ponds, where mosquito larvæ may be protected by grass and weeds and in pockets and puddles.

Where permanent abatement is not practicable, oil may be applied at intervals as a routine measure (see below).

All such measures require *systematic inspections.* In towns these take the form of periodic house-to-house inspections, made not less frequently than every nine or ten days, this being the usual minimum breeding period. The inspector should himself see to the abatement of as many breeding "nests" as possible, emptying and inverting or puncturing neglected receptacles, requiring the removal or burial of old cans and other rubbish, applying oil in emergency, and so on. In instances where work is required on the part of property owners or proprietors, written notice may be given. Detailed accounts of all inspections are to be kept, and the areas should be laid out in such a way that the whole district may be covered in due time.

The health ordinances should contain a provision making the breeding of mosquitoes a nuisance and the finding of the larvæ a proof of the fact; such nuisance is to be promptly dealt with.

Popular educational circulars may be issued with the object of obtaining public support and aid in abating breeding. Little, however, can be accomplished by voluntary effort alone; rigid inspection and enforcement of law are necessary.

2. TEMPORARY. — As a temporary measure, as well as a routine measure in cases where permanent abatement is not practicable, the application of *oil* to the water is useful. The oil used may be common kerosene, or (better because less expensive when purchased in barrel lots or more) the partly refined petroleum known as "fuel oil" — price about five cents per gallon in quantities. It has the effect of preventing egg-laying and of killing at once any larvæ or pupæ already present (through clogging the air-tubes when the organisms rise to the surface to breathe). A pint is sufficient for a water area fifteen or twenty feet in diameter. Care must be taken that the distribution is even, that small spaces are not protected from the spread of the oil film, by sticks, grass, weeds and the like, that wind does not blow

it to one side, etc. A spray pump, a can with nozzle, or a mop may be used for distribution. Deft scattering by means of a small dipper is also effective, as well as simple. Owing to evaporation, wind action, etc., the application must be repeated at intervals of ten days or so, depending on conditions. Inspectors should note such places on their rounds.

In brooks having stagnant spaces along the banks a continuous slow application may be effected by means of a drip can; this consists of a five-gallon can having a large wick extending from the bottom up through the opening in the top, and hanging down on the outside to a length an inch or two below the bottom of the can. The wick, which acts as a slow siphon, is tied securely in place and the whole appliance is hung under a bridge or tree or in some other secure place just above the surface of the water. Such cans of course require periodic renewal of oil.

The disadvantage of oiling is that it entails continued labor and expense, so that permanent abatement should be secured whenever practicable.

Screening, etc. — If the above measures were thoroughly carried out there would be no need of nettings and screens (unless for flies and other insects) and the use of citronella and other mosquito repellents, on which expedients many thousands of dollars are spent annually. But in localities where mosquito suppression is non-existent or incomplete and malaria or yellow fever mosquitoes exist, the rigid screening of cases of these diseases and of dwellings in general, combined with the capturing[1] or chemical extermination (page 592) of mosquitoes which may have gained admittance, constitute a very valuable protection.

REFERENCES

U. S. Dept. of Agriculture, Farmers' Bulletins 444 (Remedies and Preventives Against Mosquitoes), 450 (Malaria), and 547 (Yellow Fever Mosquito) (apply to Supt. of Documents, Washington, D. C.).

[1] See Orenstein, "Mosquito Catching in Dwellings in the Prophylaxis of Malaria," *Am. Jour. Pub. Health*, 1913, vol. III, no. 2, p. 106.

Doty, " The Mosquito: Its Relation to Disease and its Extermination," 1912.

Rosenau, " Preventive Medicine and Hygiene," 1913, sec. I, chap. IV.

Boyce, " Mosquito or Man " (relates especially to the Tropics).

Doane, " Insects and Disease."

See also references, p. 209.

The rôles of *other insects and vermin* (especially rats) in the spread of disease have already been referred to (page 210 f.). The use of certain insecticides is also referred to in Appendix A. Health departments do not undertake the general extermination of such insects and vermin unless there is direct or threatened danger to public health.

III. MISCELLANEOUS NUISANCES

1. **Spitting.** — Promiscuous spitting in public places should be prohibited on the scores both of disease prevention and of decency. While the danger to health from such spitting has doubtless been exaggerated (relative, for example, to other more direct modes of the spread of tuberculosis), nevertheless *some* danger probably exists. Such ordinances usually prohibit spitting upon the floor, platform or any other part of a public conveyance, upon the floor, steps or stairs of any public building, school, hall, church, store, shop or railway station, upon the sidewalk of any public or private street, upon the pathway of any park, or in any other public place (spitting on the street roadway and gutter excepted), and such spitting may be declared a nuisance. The fine should be comparatively small, say one or two dollars, so that arrests and convictions may readily be secured, and the police should be empowered to make arrests for this cause. In fact, without the action of the police little can be done by the sanitary inspectors unless they have the power of arrest. Small cards bearing a copy of the ordinance and a brief warning to be handed to offenders by patrolmen, street-car conductors and persons

in charge of public places are useful. Cuspidors should be provided in public buildings and other places where necessary. They should be of ample size and of paper or filled with sawdust so that the contents may be disposed of at frequent intervals by burning. If the contents are not thus destructible the vessel should be readily cleansable and should be partly filled with a disinfectant solution.

Under ordinary conditions the spitting nuisance appears to be less a matter of health than of decency.

2. Smoke, Dust, Gases, Obnoxious Trades. — Under this head we shall consider various aërial nuisances which have a decided bearing on comfort and more or less bearing on health, especially on the health of persons living near industrial plants or working in certain trades. In a general consideration of the smoke and dust nuisances there are, furthermore, economic waste and damage to be taken into account. Smoke and soot may also damage vegetation. Health authorities have on the whole less control over nuisances of this class than over those previously mentioned, for the reason that proving injury to health is not infrequently difficult. In many cases it is necessary to have specific statutory power granted.

THE SMOKE NUISANCE has been taken up by a number of cities and is being dealt with with increasing success as improved furnace design, mechanical stokers and methods of stoking are adopted in power houses and factories. The nuisance is greatest where soft coal is used. Unfortunately the data on the direct effect of smoke pollution on health are meagre. It seems clear, however, that deleterious effects — in some cases very considerable — must result.[1]

[1] See White and Marcy, "A Study of the Influence of Varying Densities of City Smoke on the Mortality from Pneumonia and Tuberculosis," *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. III, pt. II, p. 1020; Benner, "How and Why Smoke is Injurious," *ibid.*, p. 1015; Klotz, "Pulmonary Anthracosis — A Community Disease," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 10, p. 887.

The discharge of "dense smoke" (from factories, power plants, automobiles, locomotives, etc.) is prohibited in a considerable number of cities; the experience of the New York City Health Department may be cited as indicative of what may be accomplished in this direction. The American Civic Association has collected valuable data on the matter.[1]

THE DUST NUISANCE is another of this class. While it is generally accepted by sanitarians that the part played by ordinary dust in the transmission of disease is (as compared with other influences and modes of infection) a minor one,[2] there are nevertheless certain circumstances under which dust may possibly convey infection (e.g., mouth streptococci and tubercle bacilli) or so wound the delicate linings of the respiratory passages as to give infection a foothold. Hence it may be that many of the respiratory diseases in windy, dusty towns are thus directly or indirectly caused. While it must not be supposed that ordinary dust ranks in the same class as contact and food infection in disease causation (since, for one thing, bacteria tend to die out rapidly in dry, sun-exposed material), there is sufficient reason to consider the dust nuisance as one more or less prejudicial to health.[3] Also, of course, the consideration of public comfort enters into a large extent.

The suppression of *outdoor* dust has scarcely been touched upon by public regulations, though with the increasing use

[1] "The Smoke Nuisance" (pamphlet, 25 cents), Am. Civic Assn., 913 Union Trust Bldg., Washington, D. C. A number of publications on the subject may also be obtained from the American City Bureau, 93 Nassau St., New York City.

[2] The statement made by Prudden in his monograph on "Dust and Its Dangers," written in 1890, still apparently holds good: "On the whole, the risk of infection out-of-doors from dust, even in crowded towns, unless they are notably filthy, is not actually very great."

[3] See Winslow and Kligler, "A Quantitative Study of the Bacteria in City Dust with Special Reference to Intestinal and Buccal Forms," *Am. Jour. Pub. Health*, 1912, vol. II, no. 9, p. 663.

of motor vehicles and heavier traffic it becomes constantly more important, as affecting comfort, health and property. It is largely a matter of municipal cleanliness and highway engineering, properly to be dealt with by municipal street departments.

Certain kinds of *indoor* dust, on the other hand, constitute a very serious health problem, as, for example, in the "dusty trades" (Chap. V). In private houses and in institutions the employment of dry dusting, sweeping, indoor beating of carpets, etc., should be discouraged by educational measures as being more or less detrimental to health. The damp or dustless duster should be substituted for the feather duster. The carpet sweeper, vacuum cleaner or at least damp sweeping should replace the ordinary dry use of the broom.

GASES — OBNOXIOUS TRADES. — Nuisances due to escape of deleterious gases may be dealt with under the general power to forbid pollution of the atmosphere. In many such instances, however, it is much more difficult to prove detriment to health than interference with comfort. The same is true of the so-called "noxious trades" (better called "obnoxious") which are often unpleasant to neighbors but which, for the welfare of society, must be carried on somewhere. Such trades are tanning, manufacturing fertilizer, garbage reduction and the like. Such should be required to be conducted in the least possible objectionable manner and may perhaps be restricted to certain distances from neighboring habitations.

Aside from special local atmospheric pollutions, there is likely to be more or less illuminating gas in the air of cities, due to leaks in gas mains and piping. If this is excessive it may, as shown in Chapter V, be a distinct detriment to health.

3. **Noise.** — Excessive noise has long been recognized as a nuisance affecting comfort, but only recently has scientific attention been directed to it as a detriment to health. Even as yet (as is the case with many of the nuisances of

class III) there is little direct evidence as to its effects on the human organism, although there is no question in experience that such effects result in losses in health, comfort and efficiency, which, in the case of many persons of sensitive nervous temperament, may be very considerable. With the increase of noise in cities and in the neighborhood of industrial plants and with the increased strains placed on the nervous system by modern life in many directions, there is developing a movement for the suppression of unnecessary noise. The difficulty will be to determine which noises, out of those incidental to life in modern communities, are unnecessarily detrimental to public health and comfort. In many legal decisions on record, the courts have expressed themselves as perplexed over questions on this point. Health authorities have not gone very far in noise suppression, and most of the decisions have been under police actions or suits by private persons for indictments or damages for disturbance of comfort or of use of property. Already "zones of quiet" for the protection of hospitals are established in some cities, and the movement for general restriction of noise, under control of either police or health authorities, should continue to develop.[1] Such movements indicate the increasing attention being paid to the protection of the senses in modern life.

[1] See Blake, "The Suppression of Unnecessary Noise," *Trans. XV Internat. Congress on Hyg. and Demogr.*, 1912, vol. III, pt. II, p. 533; and Bell, "Existing Legal Provisions with Regard to the Suppression of Unnecessary Noises," *ibid.*, p. 536. A number of publications on the subject may be obtained from the American City Bureau, 93 Nassau St., New York City.

CHAPTER VII

SANITARY LAW

The general status and powers of health authorities have already been outlined in Part I, Chapter I. We shall add here only a few remarks on the making and enforcing of ordinances.

Laws and Ordinances. — Under the police powers assigned to local health authorities by state legislatures — which powers are defined by the statutes in general rather than in specific and detailed terms — it is necessary that such authorities exercise a quasi-legislative function in passing ordinances to meet local conditions. Such ordinances should be framed by the legal counsel of the board of health, on the basis of data submitted by the health officer, so as to be in conformity with legal powers as well as sanitary requirements. Further, the law frequently provides for the just right of citizens to be heard on an ordinance pending passage and for the advertising of ordinances proposed or adopted, prescribing the procedure to be followed.

Without going into technical legal points, it is well that health authorities should recognize the following principles in the adoption of regulations.[1]

(1) *The condition which is sought to be met must be sufficiently important to warrant the remedy proposed.* In other words, the public health must be materially and demonstrably affected and the benefits to be gained from the remedy greater than its expense and inconvenience.

(2) *The remedy proposed must be reasonably adequate.* It is proper, however, since perfect control and regulation

[1] Evans, W. A., "Legal Powers of Health Departments," *The American City*, Aug., 1912, p. 121.

can in practice be gained only by stages, to establish advancing standards, that is, to proceed from moderately stringent to more stringent ordinances. In cases where a very radical set of regulations would be impossible to enact and enforce, the control may be gained by steadily raising the requirements from time to time. Ordinances may be adopted providing for the application of certain regulations after a certain date or permitting one standard for future installations or performances and another for present or past. Thus the theoretical principle of perfect adequacy is compromised by practical considerations, the highest standards enactable and enforceable at the time being adopted in progression. But, on the other hand, under propitious conditions — e.g., a new administration or favorable public sentiment — it may be possible to put through sweeping changes.

If ordinances are reasonable, as above implied, they will not work *undue* hardships on the property and rights of individuals. Very stringent regulations working serious hardship may, however, be necessary when a grave consideration of public health is at stake. Health authorities must, of course, be prepared to justify such regulations.

Legal Remedies. — The sanitary law affords several different kinds of remedies (some of which have been mentioned in the last chapter) under both civil and criminal procedure, by private and by public action. These include suit for damages and fines, injunction, etc. The procedure commonly adopted by health authorities is that of *suit for collection of the penalty* or penalties for a statute or health ordinance which has been violated. On filing of a complaint in proper form the court issues against the defendant a warrant (for arrest) or summons (for appearance), as the case may require, usually the latter.

An important and necessary part of every ordinance is the *penalty clause*, without which it is impotent. In this connection it may be observed that, while very heavy

penalties are impressive, there is likely to be hesitancy in their enforcement; the penalty should be adapted to the importance of the offense and should be greater for second and subsequent offenses. In the case of nuisances and other continued conditions each day should constitute a separate offense. Statutes may provide, for cases in which the fine is not promptly paid, the further measure of imprisonment. In some instances costs of nuisance abatement, etc., may become a lien on the property of the offender.

Enforcement. — No matter how much willing coöperation is obtained by the health department there will always remain a certain number of instances in which compliance with the law can be obtained only by prosecution. As soon as such cases are recognized by the authorities they are bound to take legal action without fear or favor.

There is, however, one preliminary to be disposed of. Although there is a legal maxim that "ignorance of the law is no excuse for its breach," it is nevertheless an accepted principle that the person responsible for a condition or act contrary to public health law receive due written *notice* in order that he may have the opportunity to adjust himself and his property to the requirements of the law. This is only reasonable, since most persons are unacquainted with the more detailed and technical requirements. The giving of such notice and its form and manner are usually provided for in the law itself. This has in some instances been carried to extremes of formality. Notices need only be so worded, in accordance with the terms of the ordinance, as to be clear to a man of average intelligence. The necessary blank forms for notices should be drawn up under legal advice; then only the particulars need be filled in for each case. The notice is then served strictly in the manner required by law.

In all cases care should be taken to notify and, if necessary, prosecute, the person who is actually responsible

rather than an employee or agent, though the latter is sometimes the only one who can be reached. Thus, in prosecutions under ordinances governing milk supplies, the person or firm under whose care improper handling or adulteration takes place, wholesaler or retailer, should be the object. But if it is found that the wholesaler or farmer is at fault and cannot be reached by local prosecution, the retailer of the supply should be given notice so that he may change his supply and thus avoid prosecution.

The following points in regard to *prosecutions* are worth noting:

(1) The *evidence* upon which a case is to be based must be adequate and reliable. Recourse should not be had to a court of law without a reasonable certainty that sufficient proof can be offered. Witnesses must be reliable and testify of their own direct knowledge regardless of hearsay, which is of course worthless as evidence.

(2) The authorities should be prepared and determined to *push every case through to its logical conclusion.* Appeal to higher courts should be taken if necessary and the case is one in which success is reasonably to be expected. Very frequently after a case has been started the defendant will at once take steps to comply with the law, and this may be argued as a reason for discontinuing the suit when compliance is seen to be secured. But as a general rule judgment should be secured and the penalty should be exacted as a deterrent from future offences and in order partly to repay the health department for the time put into the case. The authorities who gain a reputation for fighting to the end will find their work much facilitated, while a reputation for leniency can only have the opposite effect and lead to disrespect for the law.

(3) The *publicity* given to prosecutions is a valuable assistance in securing compliance with law.

(4) *Laws should be enforced uniformly* and prosecutions should not be withheld on account of the personal influence

or reasons. Such a policy is not only unjust, but in the long run leads to disrespect of, and resentment against, the law.

Tendencies in Sanitary Legislation. — Several noteworthy tendencies are to be seen in public health legislation today. One of these is the increasing importance of specific statute law defining the powers and duties of health authorities. This is in line with the growth of definite scientific knowledge of methods of prevention. So long as legal powers are vague and overgeneral, action is uncertain, but specific law both permits and requires effective action. Health reforms clearly needed should be crystallized in such law.

Along with this there is the movement to require expert service and to entrust technical questions to those qualified to deal with them.

Again, while in the past there has been perhaps an undue emphasis on the vested rights of individuals and corporations, it is now the tendency to enact thorough socially constructive laws by which those rights, while duly respected, are subordinated when public health is at stake. At the same time damages to the private individual through public conditions over which he has no control are coming into a status as subjects for compensation. Thus it is possible, according to at least one important decision [1] for the individual to recover damages for sickness caused by a polluted public water supply. Again under workmen's compensation acts the purity of water supplied by employers (as well as other sanitary matters) may come into question.

In general, a reform of public health laws to harmonize with modern sanitary science is needed. This would result in a correct perspective and in considerable clarification through the elimination of obsolete sections of the law. The new public health law and regulations recently adopted

[1] See note, p. 413.

in New York State is an example of such reform. On the other hand, a uniformity which would stifle development of procedure is to be avoided.

Finally, it must be remembered that, under a democratic system, consent to the adoption of laws depends ultimately upon public sentiment, which should be gradually moulded to sanction the standards needed.

REFERENCES

Among the legal works dealing with public health are the following:

Parker and Worthington, "The Law of Public Health and Safety," 1892.

Joyce, "The Law of Nuisances," 1906.

As an example of a manual on local state law (New York State) may be cited Bender's "Health Officers' Manual" (Bender and Co., Albany, N. Y.).

Cf. papers by Ball and Hemenway in *Jour. Am. Pub. Health Assn.*, 1911, nos. 2, 4, on powers of health authorities.

CHAPTER VIII

THE ANNUAL REPORT

Value and Use of Annual Report. — One of the major duties of the health department is to publish a good annual report. For communities of the smaller size such report need not necessarily be lengthy or expensive, but should cover all the essential points. The importance of the annual report has not been sufficiently recognized; by too many health officers and boards it is regarded as a perfunctory extra labor to be put off to the latest possible time or even to be omitted entirely. Needless to say this attitude is a mistake. The annual report is the necessary accounting of the health officer to the board for the work of the year; it is the accounting of the health department to citizens and municipal government for the funds appropriated; it is to the health officer himself an indispensable review of the year's work and a basis for laying plans for the future and making recommendations; and if it sets forth administrative progress as it should it is of comparative interest and value to health departments of other communities. It should also embody matter of popular information and use, as when the names of milk dealers are published in the order of their standings. Since the results of public health work are not evident to the public eye as those of some of the other departments of municipal activity, it is all the more important that they should be set forth as tangible facts.

If proper weekly and monthly (and even daily) reports of health officers and inspectors are kept, the composition of the annual report should not be an excessive task. The

health officer should present monthly a written report to his board summarizing the work performed by him and under his direction, and these monthly reports will assist greatly in making up the annual report. The facilitation of reporting is indeed one of the chief advantages of a good recording and filing system; but on the other hand, if work is performed without constant record being kept it is impossible to make it appear and obtain credit for it.

For the maximum value of an annual report two things are necessary: that it should be in proper form and inclusive of all essential points, and that it should be issued with reasonable promptness. Care should be taken that it is in the hands of the municipal authorities at the time when appropriations are made. In any case a report published long after the close of the year has lost a great deal of its interest and value.

Standard Plans for Reports. — Owing to the lack of uniformity in essentials in local health reports, the formulation of standard plans for the assistance of the health officer has been undertaken in at least two states (Massachusetts and New Jersey) by committees between which there was some conference. The plan adopted by the Health Officers' Association of New Jersey is reprinted in the present volume (*Appendix G*). That of the Massachusetts Association of Boards of Health has already been published elsewhere.[1]

The use of such a plan should not discourage initiative and individuality of treatment, for it applies only to the fundamentals which should be covered by any health report.

A consideration of the published health reports of the better class is recommended. Among small cities which issue full and effective reports may be mentioned Montclair, Orange, and Plainfield, N. J., Brockton, Mass., and Palo Alto, Cal. In Montclair an approach is being

[1] See note, p. 621.

made toward the presentation of unit costs for the various items of health work. Among reports issued by the larger cities those of Providence, R. I., Richmond, Va., and Jacksonville, Fla., merit special mention for analysis of administrative problems and interpretation of vital statistics.

DISTRIBUTION. — The annual report should be distributed by mail or by direct hand distribution to city officials, physicians, the more prominent citizens, ministers, milk dealers, and others who would be directly interested. A certain number should also be sent, as "exchanges," to other health departments, particularly those of places of about the same size and those in the same state. The reprinting of certain portions of the report and its distribution as a popular bulletin will be mentioned in Chapter X (page 553).

PRESS NOTICE. — It is important that arrangements be made for a good press notice in connection with the report. Local newspapers should be furnished several days beforehand with copies of the report which the health officer intends to read to his board, or at least of the more important portions of it; which may be thus printed at some length as soon as the reading has taken place. Such publicity is very valuable and the press will appreciate the opportunity to print and perhaps support by editorial comment the annual message thus delivered by the health officer.

CHAPTER IX

VITAL STATISTICS

Vital statistics, according to Newsholme, is the science of numbers applied to the life history of communities and nations; Wilbur calls it the Cinderella of modern public hygiene, sitting in the chimney corner sifting the ashes of dusty figures while the proud sisters, bacteriology and preventive medicine, go to the ball and talk about the wonderful things they have done; a third statistician, Guilfoy, defines it more precisely as "the numerical registration and tabulation of population, marriages, births, diseases,[1] and deaths, coupled with analyses of the resulting numerical phenomena with the end in view of 'searchlighting' the path of sanitary progress."[2]

Vital Statistics are the Indispensable Basis of Public Health Work. — This is a fact not sufficiently recognized among health officers, who not infrequently regard the annual report with its necessary tabulations as formal rather than useful. On the contrary, public health work can no more be directed intelligently without statistics than can a business be conducted without figures for income and expenditure, profit and loss. Instead of being regarded as mere formality and history, vital statistics should be the constant basis of public health work. If certain tabulations are kept up from week to week and from month to month, the health officer will always have

[1] The term "vital statistics" is not always taken to include statistics of disease (morbidity statistics). — J. S. M.

[2] Guilfoy, W. H., "Vital Statistics in the Promotion of Public Health," *New York Medical Journal*, November 5, 1910, and *Jour. Am. Pub. Health Assn.*, 1911, vol. I, p. 486.

the main data in mind and the dreaded composition of the annual report will be much facilitated. This will also make for promptitude, for statistics should be fresh — tabulated as soon as data are complete. Those published months later have lost both in interest and virtue.

Practically, the value of vital statistics may be seen. Thus Abbott, writing some years ago, said that "Those states which have made the most commendable progress in preventive medicine are also the states which have brought their systems of registration to the highest degree of perfection."

The processes of vital statistics are frequently thought to be highly technical and mathematical. It is true that the "theory of statistics" is a mathematical subject and one which easily runs into abstruseness in its advanced aspects. But the health officer need not be discouraged, for the comparatively little theory which he needs to know is simple, though he needs to know this little very thoroughly. The former Chief Vital Statistician of the U. S. Census, Dr. Wilbur, tells us that "*no great degree of mathematical attainment is necessary for some of the most important practical applications of vital statistics.* The ordinary ratios or 'rates' employed in vital statistics are as easily computed and understood as the 'percentages' so familiar to the baseball public." The necessary knowledge of vital statistics and its processes is, therefore, well within the reach of the health officer.

Says Whipple:

Vital bookkeeping is carried on much as ordinary bookkeeping. There are daily entries of accessions and losses as they occur, corresponding to receipts and payments; there are weekly statements, monthly statements, and annual statements; and at longer intervals there is a taking account of stock, that is, a census. This difference, however, should be noted. Accounts are accurate records of transactions and if properly kept an exact balance will be obtained. Vital statistics are not always accurate. The individual data are incomplete and subject to error. The results, therefore, lack the precision of monetary

accounts. It is necessary to keep this fact constantly in mind when interpreting the results of statistical studies.[1]

Vital statistics, to be of benefit to the community, must be used, says Whipple, "with truth, with imagination, and with power." They must be accurate, their application to the situation must be brought out, and they must be brought home forcefully to the people and those responsible for the care of the public health. A conspicuous example of the use of vital statistics on an enormous and highly practical scale is to be seen in the life insurance companies; whose actuaries have been successfully occupied for years in turning vital ratios into dollars and cents, — the severest test of practicality.

The need of having the care of vital records of births, marriages and deaths in charge of the health department and not in the office of the town clerk or other non-sanitary official has been discussed in Part I. Only by that arrangement can the records be properly controlled and the tabulations be conveniently made.

Twofold Value of Vital Records. — The records of births, marriages, and deaths have two separate and distinct uses:

First, as permanent *legal evidence* of the events to which they certify. Until the enactment of registration laws, births, marriages and deaths were registered only in family records and churches, and it is unfortunate that even today, owing to the deficiency of local records, recourse must sometimes be had to those uncertain sources. Because of their important legal functions the absence of a proper record may cause grave inconvenience if not actual loss to the individual.

Second, as the *basis for vital statistics*. Every certificate contains some information which is for the identification

[1] Whipple, George C., "The Use of Vital Statistics in the Public Health Service," *Pub. Health Jour.* (organ of the Canadian Public Health Association), June, 1913.

of the individual but of no use for statistical purposes, some which has both an identificational and statistical value, and finally, some which is primarily statistical. Birth certificates, moreover, have a special use as the basis of infant hygiene work, while death certificates of tuberculosis and other diseases are of direct value in the control of those diseases.

REGISTRATION

The various steps in registration are:

1. Recording.
2. Tabulation from records.
3. Study of statistics thus obtained.
4. Presentation and interpretation of results.

They will be taken up individually.

1. **Recording.**[1] — The first of these steps presupposes a good registration law. The laws of the various states differ greatly, and the obtaining of a good state system of registration, being incumbent largely upon state authorities, need not be dwelt upon here.

For the reporting of births the time limit allowed in various states varies from 24 hours to 30 days, while in a few instances there is no law at all on the subject. The persons required to report are: physicians, midwives, and, in the absence of professional attendance, the parents. Experience shows that allowing a greater length of time does not tend to increase the efficiency of reporting; on the contrary, compliance with a short time limit may reasonably be expected if certificates are accepted, when need be, without the given name of the child. In this case, however, it is necessary to see that the name is returned later, as a legal correction to the certificate. It has been proposed, in order to obtain prompt information for the purposes of infant hygiene, that there should be provision for (1) a preliminary notification within a short time, say

[1] See distinction between recording and registration, p. 614.

24 hours, after the birth, giving the name and address, this to be followed later by (2) a full registration.[1]

The laws governing the recording of *deaths* and *marriages* vary. It is required under efficient systems that the death certificate be filed and a burial or removal permit be issued before the body is permitted to be buried or removed.

Good Registration and How to Obtain It. — There are two requisites to good registration: first, that it be *complete;* second, that it be *accurate*. Thus, the registrar must not only see that all certificates are recorded; he must also scrutinize each one for errors and deficiencies and refuse to receive incomplete or apparently inaccurate certificates.

While the law is as a rule state law, the enforcement of it devolves first of all upon the local registrar. This means constant vigilance, a searching out of deficiencies and, frequently, an active campaign for good registration. Where registration is poor the situation is almost always due to lack of strictness on the part of the local registrar. Most of the physicians and others who are remiss in their duty of reporting are unconsciously so and need only be stimulated to proper performance by a clear statement from the registrar dwelling on the importance of good registration and his intention of obtaining it. In those few instances where notification is disregarded the guilty party should be brought to book and made to pay the legal penalty. The physician, being protected in the practice of his profession by the state, should be all the more active in complying with the state law, by reporting his births promptly.

Reporting of deaths is, in general, much better than that of births, owing to the now widespread practice of requiring the death certificate to be exchanged for a

[1] Atherholt, G. W., *Am. Jour. Pub. Health*, 1913, vol. III, p. 451. Such a provision has been adopted in Massachusetts (Chapter 280, Acts of 1912).

burial permit before burial or removal, under severe penalty.

Marriages should be recorded with the same degree of care as the other vital records. What has been said in regard to the enforcement of the birth registration law applies in principle here. In those states where a marriage license requirement is in effect, the completeness of the marriage returns may be checked up on the license stubs.

Every efficient registrar will devise various checks by which he can ascertain what deficiencies there may be in the returns and can locate the persons responsible for them. Such data furnish a means of extending the value of the statistics and at the same time of improving registration.

Checks upon Birth Records. — The following checks are applicable to birth recording:

(1) All deaths of infants under two years of age should be checked back against the birth records in order to ascertain whether the births were reported, omitting of course those where the death certificate gives an out-of-town place of birth. This may conveniently be done monthly when the certificates are being made ready to transmit to the state authorities. Cases in which the name is missing from the birth records are made the subject of a visit to the home for further information. If it is found that the birth occurred in town and that the professional attendant failed to report, the matter is then to be taken up with the latter.[1]

[1] The following extract from the Report of the Board of Health of Montclair, N. J., for 1913, is illustrative of the defects found: "In checking back the deaths of children to determine whether the corresponding birth certificates had been filed we also found gross irregularities, especially in the spelling of the family name. In many cases it was impossible to locate the birth record from the card index, and it was only by looking up the record in the original book, using the date of birth as stated on the death certificate as a guide, that the corresponding certificates could be found. Any method of checking up the percentage of reported births from the death records is bound to be in error

(2) It may be feasible to make canvasses of certain districts, obtaining names, addresses, and dates of all births that have occurred within the year, which may then be checked back upon the records.[1]

unless the original records, arranged in chronological order, are searched. The following illustrates some of the discrepancies found:

Death Record		Birth Record
Colone		Calama
Cerona		Tchiron
Steffano		Stivale
Ferrari		Veria
Entille		Intile
Spariano		Spaciamma
De Gaita		Di Kito
Christophi		Christianna
Aoccella		Cicollela
Garis, Willie		Garis, Nellie
Ryan	(out of wedlock)	Phelan
Sheppard	(out of wedlock)	Bradley
Yanno	(out of wedlock)	De Angelo."

[1] The following is the experience of Montclair, N. J. (Rpt. just quoted):

"In a large section of the town that was canvassed for unreported births we found only one case in which a physician had failed to file the return, and he claimed that he had mailed it, but we found about a dozen cases in which midwives had not made returns and we also found that there were gross errors in names, dates of birth, and in other particulars on many of the certificates that had been filed . . . Our birth records, will not be complete until a yearly house-to-house inspection of the entire town is made for this purpose. Even if all doctors and midwives reported all of their births there would still remain the few cases in which there was no attendant at birth or in which some unregistered person officiated."

The following procedure is also proposed:

"We have decided that we can nearly reach the 100 per cent mark in birth registration, and also gain the great advantage of having accurate records, by the following method: As soon as a certificate of birth is filed a transcript is made on a specially attractive form and sealed with the official seal of the office. This copy is mailed to the parent of the child, together with a circular letter in which the importance of accurate birth registration is outlined and in which the request is made that the

Health department nurses and inspectors, if alert, may in the course of their rounds learn of births and may be required to keep regular lists of these, with data as to name, date and place of birth, to be checked up on the records.

(3) The records of hospitals may, through the courtesy of the hospital authorities, be examined at least once a year for comparison with the official birth records. There may be a lack of understanding between institution and physicians through which there is failure to report.

Checks upon Marriage Records. — Marriages may be checked up through the marriage licenses where these are required by law. Otherwise announcements published in the newspapers may be used as a partial check.

Checks upon Death Records. — The records of cemeteries may be compared from time to time to ascertain whether any burials have taken place without the legal filing of a death certificate (or whether burial permits have been obtained in the wrong sanitary district, as sometimes occurs). Access to the records of deaths in hospitals may also be obtained. The law requiring proper burial permits should be very strictly enforced and the practice of burying first and obtaining a permit afterward should not

record be returned for correction if errors are noted. [Text of letter given.] . . . It is expected that parents will soon learn that they should receive such a certificate and will send to the office for it in case they do not receive one so that we will thereby obtain a record of unreported births. We believe that errors will be corrected promptly and the value of the certificates thereby greatly increased. We expect that the school authorities will coöperate by requiring the presentation of such a certificate upon admission to school, so that we will thereby obtain a check upon the records of children born four or five years ago." It scarcely needs be said that all this represents an effort for perfect registrative efficiency and one requiring considerable increase in clerical work. There would also be much extra work if the certificates were followed up in ignorant or foreign families whence they would not otherwise be returned. The practicability of the plan would, therefore, depend upon the intelligence and coöperation of families and upon the labor available for its operation.

be tolerated. Burial without due procedure as required by law constitutes a serious offence.

Proper recording further demands a proper system of copying[1] and transcribing records, with regular returns of the original certificates to the state registration office. It is customary to make certified transcripts of the records for persons requesting them at a small fee, these constituting *prima facie* legal proof of the record. It is scarcely necessary to say that the official may not alter a record in any particular; this can only be done by the person responsible for making the return. If the original certificate has been transmitted, a corrected certificate or other legal form may be made out and filed.

2. **Tabulation.** — The objects and methods of tabulation will be taken up presently.

3. **Study of Statistics Obtained.** — This is a most important point, though too frequently neglected. Indeed, even to determine the tabulations required demands some study of conditions and of the figures for previous years. As Whipple says, "the man who merely tabulates data and does not study them is a clerk and not a statistician." The consideration demanded is usually in the nature of analysis, detection of errors and fallacies, and searching into underlying factors. These matters will be taken up later.

[1] The best form for permanent local copies of records is probably a series of books into which the certificates are copied by hand, an alphabetical card index divided by years being kept. Births, marriages and deaths should, of course, be kept separate. Stillbirths should be kept in a separate book, also "late birth returns," when deficiencies in the records for previous years have had to be supplied. Births may conveniently be indexed under the name of the father (for births out of wedlock under the name of the mother) and marriages under the name of each party. The chief disadvantage of card index systems is that cards may be misplaced; this may be guarded against by having a locking index such that cards cannot be removed, and by checking up each batch of certificates against the index before transmittal to the state authorities.

Finally come:

4. **Presentation and Interpretation** of the statistics, by which alone they can be made clear and forceful to others than the official who has made the study and by which they become even more cogent to him.

We have dealt thus far with original statistics, those produced from records in the local health office. But it is sometimes necessary for the health officer to refer to various *official sources*. Here, while the figures may be accessible in convenient form, certain dangers and fallacies, which we shall mention in a special section, must be guarded against. We may distinguish three kinds of published (official) statistics — federal, state and local. These are *in general* to be relied upon in the order given, the federal being the most, and the local the least trustworthy.

For population figures recourse is to be had to the results of the Federal Census, taken every ten years — e.g., 1900, 1910, etc., — and, in certain states, to the State Census,[1] taken every ten years on the half-decade — 1895, 1905, etc. By the use of these figures, together with proper estimates for the non-censal years (see p. 504), an accurate population basis for vital statistics may be obtained.

The Federal vital statistics of births and deaths, while the most trustworthy that we have, are subject to certain limitations which the Census Bureau recognizes and describes. The United States has as yet no general statistical system such as has been established in some of the older countries. The Bureau of the Census has been steadily striving to improve the registration of deaths and with success, as is evinced by the addition from year to year of states to its "registration area." This *registration area*, it may be stated, comprises those states (and certain cities

[1] Inquiry should be made as to whether such censuses are approved by the U. S. Census Bureau.

in other states) in which the death returns are considered sufficiently accurate to be included in the Federal mortality tables. In 1910 it included 21 states, and returns were also accepted from the District of Columbia (City of Washington) and 43 other cities in non-registration states, or a total population of not quite three-fifths (58.3 per cent) of the population of the country. The registration area for births was established later and includes a much smaller reporting population (about one-fourth of the population of continental United States). Without a full registration of births no correct infant mortality rates can be computed for large areas in which that registration is deficient.[1] The present incompleteness of federally-collected statistics is, therefore, due to the lack of proper state and local registration.

The careful student of vital statistics will notice certain discrepancies between the figures given by local, state and Federal authorities for the same city. These, due to differences in classification, differences in the exact period covered, and even to typographical errors and other causes, have been discussed by the Chief Vital Statistician of the Census in a paper to which those who wish to inquire into the matter are referred.[2]

However, from year to year published reports are on the whole becoming more inclusive and trustworthy.

ELEMENTS OF THEORY

In statistics we deal with units — such as single cases or deaths — the data from which are combined to form numbers, which are then considered as regards their distributions and their ratios to other numbers.

[1] See "Birth Registration," Monograph No. 1, Children's Bureau, Department of Commerce and Labor, 1913.

[2] Wilbur, "The Necessity for Uniformity of National, State and Municipal Vital Statistics," *Am. Jour. Pub. Health*, 1913, vol. III, no. 5, p. 413.

First Principles. — In statistical work the following three rules must be observed:

(1) *Define* clearly the units which are taken as a basis — e.g., if they are deaths, state exactly what deaths are included, so as to leave no doubt of the scope of the statistics. Such definition should be made in the heading of each statistical table. Mention also any conditions which may affect the value of the figures, also any material assumptions which are made.

(2) Have *accurate and sufficient data.* The greater the number of separate units included, the greater the accuracy of the figures, for incidental errors tend to counterbalance one another when taken in large numbers. Just how accurate and how numerous the data must be is a question to be settled by circumstances.

(3) *Focus the figures* on one or a very few points at a time, eliminating so far as possible all other points. It is frequently desirable to make a number of separate tabulations rather than attempt to cover all the points at issue in one, which would be too complex and extensive.

Numbers may be either *absolute* or *relative.* Absolute numbers tell us nothing, for no number is significant except by comparison; hence the statistician does not stop with an absolute number, but compares it or combines it with some other or others. For example, to state that 100 deaths occurred in a certain town in a certain year means nothing unless the population of the town is known, and for a thorough knowledge of the significance of the figures we should have to know the causes of the deaths, the ages of the decedents, and other facts. From such facts we may form the relative distribution and ratios (or rates) which alone are significant.

Distributions. — If a number be made one of a series so that its relation to the rest of the series is apparent, useful comparisons may be made. This is what is done when the death rate of a town for one year is compared

with the rates for other years. Or, if a number which conveys little or no information be analyzed, its components may be found significant. A quantity of "60 typhoid fever cases" would give only a crude idea of the typhoid situation; but if the distribution of the cases according to residence, age, sex, source of water and food supplies, etc., were known, valuable conclusions might be drawn. Thus, if an absolute number be made one of a series of relative and comparable numbers, or if it be split up into such a series, useful information may be obtained.

Ratios, or Rates. — A distribution involves several numbers, whereas a ratio is the relationship of one number to another. Conversion into ratios is the commonest way of making absolute numbers relative and comparable. This gives the birth rates, death rates, etc., which play so large a part in statistics.

Among statisticians, certain rules have been formulated for the calculation of the principal rates and other figures, and certain terms have been agreed upon. Thus only can rates be "corrected" or *standardized* so as to be comparable. This matter of standardization will be taken up again under the subject of death rates, to which it chiefly applies.

Averages, Maxima, Minima, etc. — The health officer need not usually go into the mathematical theory of probability, error, etc.; his data may usually be judged on other considerations. One or two cautions may, however, be in place.

In taking an *average*[1] (or arithmetical mean, obtained by dividing the sum of a number of quantities by the number

[1] The term "normal," which is frequently met with in such expressions as "the normal temperature for the month," "the normal typhoid death rate," and the like, is usually meant in the sense of "average." Used in this sense it is likely to mislead; e.g., a death rate which has been for a number of years "normal" to a certain place may be in reality highly abnormal when judged by proper public health standards. The term "average" should be used in all such cases.

of the quantities taken), care must be taken that the number of facts is sufficiently numerous to insure a true representation. Thus, if we average 2 deaths in one month with 10 deaths in another the monthly average obtained is 6, but the significance of this figure is much less than if the number of months taken were greater, say including a whole year. This can readily be seen in such an instance, where there is so great a variance from month to month. Again, to average the results of only two or three analyses of a certain milk-supply would perhaps be misleading, while the average of a greater number of samples taken within a short period of time would give a trustworthy figure.

The average, moreover, is not always the truly indicative figure. It may frequently be the *maximum* or the *minimum* which is really required. A milk-supply, for example, might run excessively high in bacteria during one or two periods which would be concealed in a general average for the year. A water-supply might be subjected to occasional pollutions sufficient to cause epidemics while its general average appears quite respectable. In the same way the total of the typhoid fever cases during a year might give no distinct indication of epidemic increases which had taken place at particular times during the year. In other words, averages give no indication of distribution or variation, while maxima and minima have the virtue of indicating undesirable extremes.

A figure known as the *median* is sometimes used. This figure is such that in a series of quantities there are just as many above as below it. This figure is especially useful and is more indicative than the average in any series where the distribution of the quantities is so uneven that the inclusion of those at one extreme unduly influences the average obtained. Thus, in the series 1, 2, 3, 4, 5, 6, 7, 8, 20, 30, 40, the median is 6, while the average, on account of the three high numbers at the end, is 11.5. In the U. S.

Registration Area in 1910 the average age at death of bronchopneumonia cases was 19.7 years; but the median was only 1.5, showing the disease to be one chiefly of infants, an important fact not indicated by the average.

As to theory and practical statistical work, it must be remembered that while in institutions, etc., and under special conditions very exact work is possible, in general public health work the conditions are at present far from ideal. The quantities dealt with are by no means mathematically exact, many fluctuations are unmeasured, and the health officer as statistician must be constantly correcting, elucidating and qualifying.

STATISTICS OF POPULATION

Population is the basis of vital statistics. The study of populations and of the "movement of population" (the effect of births, deaths and migration) is an important branch of statistical science included in the general scope of the science of Demography (a term from the French statisticians, not as yet in very general use).

Censuses. — A growing population is subject to increase by the surplus of births over deaths (since births are commonly more numerous than deaths) called the "natural increment"; it is also influenced by migration. In the United States, where immigration is so much more important than emigration, great increases are experienced from the latter cause. The total increase in population from time to time is called the "actual increment," being the net result of all factors affecting the population. The population is determined at certain intervals by means of a census, which is taken as of a certain definite date. The United States Census, under the Bureau of the Census, Department of Commerce, is taken every ten years on the even decades: 1900, 1910, 1920, etc. In addition, certain states take a census of their own on the intermediate semi-

decades: 1905, 1915, etc.[1] The results of the Federal Census are published in a series of bulletins and volumes, the 1910 Census being known as the Thirteenth.

Population Estimates. — It is necessary to determine the population for intercensal years by *estimation.* For this purpose various methods have been proposed. Since populations are subject to all kinds of unmeasured fluctuations, any estimate is subject to error and the question arises as to what method is the most dependable.

This question has been answered by the Bureau of the Census, which, after thorough consideration of various methods, recommends what is known as the *U. S. Census method* of estimation,[2] which consists in arithmetical interpolation between and beyond the two latest censuses. In other words it assumes that the actual *amount* of increase of the population each year is the same; so that it is only necessary to take the difference in population between two censuses, divide by the number of years intervening, and, beginning with the earlier census, add that quotient for each successive year. In its simplest form, to illustrate the principle without for the present referring to the correction for mid-year population which will be taken up below, the following example is given.

Example. — The population of a certain town was 15,321 in 1900, and 19,542 in 1910.[3] The interval between the censuses we shall assume is exactly ten years, during which the town gained 19,542 minus 15,321, or 4,221 inhabitants, an average annual increase of (4221 ÷ 10 =) 422.1 inhabitants per year. To obtain the populations for the intercensal years simply add the average annual increase, 422 (dropping the fraction for simplicity), for each year, thus:

[1] See note, p. 498.

[2] Used in the U. S. Census publications and prescribed for use by health officials and others by the American Public Health Association (Rules of Statistical Practice, 1908).

[3] These should be *mid-year* populations, as will be explained below.

Population for 1900 (census)	15,321
Add	422
Population for 1901 (estimate)	15,743
	422
Population for 1902 (estimate)	16,165

And so forth, the last figure being:

Population for 1909 (estimate)	19,119
Add	422
[Population for 1910 (by addition)	19,541]
[Population for 1910 (census)	19,542]

The last sum, being practically the same as the census population, being a check on all the previous additions.

To obtain the estimates for *postcensal* years, assuming that there is no census later than 1910, simply continue on as above:

Population for 1910 (census)	19,542
Annual addition	422
Population for 1911 (estimate)	19,964
	422
Population for 1912 (estimate)	20,386
Etc.	Etc.

From this example, for the sake of simplicity, is omitted one noteworthy feature of the method — that is the use of *mid-year populations*. Where annual rates are to be calculated the greatest degree of accuracy will be obtained by basing them upon the assumed population at the middle of the year, July 1. Formerly the Federal Census was taken as of June 1 of the census year, and this was so near mid-year that the Census, in calculating rates, made no correction for the difference. But in 1910 the Census was taken as of April 15, making a difference of $2\frac{1}{2}$ months from the middle of the year; and beginning with 1910 the Census has applied a correction so as to base its rates upon mid-year populations. Local registration officials

should follow this example and reduce all their population figures to a mid-year basis. This is the more important the more rapid the growth of the community.

The process of estimating the mid-year populations for 1900 and 1910 from the census enumerations as of June 1 and April 15, respectively, is very simple. In former estimates, when each census was of date June 1, the interval between them was exactly ten years or 120 months. The interval between the census of June 1, 1900, and the census of April 15, 1910, is not 120 months, but only 118.5 months; dividing the observed increase of population for a given area by 118.5, the average monthly increase during the decade is obtained. This monthly increase added to the population June 1, 1900, gives the mid-year population for 1900, and two and one-half times the monthly increase added to the population of April 15, 1910, gives the mid-year population for 1910. One-tenth of the difference between the two mid-year populations is then added successively for the intercensal years 1900 to 1910 and the postcensal years beginning with 1911 [just as in the example above]. Suitable allowance must, of course, be made for changes of area.[1]

The final check on the postcensal estimates, i.e., estimates made since the latest census, lies in the nearness of their agreement with the results of the next following census. Thus, according to the estimation in the above example, the population for 1920 would be 23,762, but if the census of that year should show an actual population of, say, 22,478, then the estimates since 1910, being in error, must be revised to agree with the new figure. There is always, of course, such an error, greater or less, in estimated postcensal populations. Since the error is frequently very considerable, good practice demands that this rule be followed: *after each census revise the postcensal estimates previously made:* re-estimate the populations, taking the new population figure into account, and where necessary recompute the rates based upon the first and less accurate

[1] Annual Bulletin on Mortality Statistics, 1909, Bureau of the Census. (Quoted in Rosenau's "Preventive Medicine and Hygiene," 1913, p. 901.) The U. S. Census method may readily be applied by the health officer to the local population figures, or the Census Bureau will estimate the populations for any community on request.

population estimates. Where state censuses are taken in the interval between Federal censuses they may, if approved by the Federal Census Bureau, be made use of, the estimation being made through five- instead of ten-year periods.

DEATHS

DEATH RATES

Of chief interest to the health officer are mortality statistics, for the information afforded by death rates is of the greatest importance. The following are the general definitions relating to death rates. The terms paired in brackets are contrasted with each other.

A *general death rate* is the ratio obtained by dividing *total* deaths (irrespective of cause, age, etc.) into the population among which they have occurred. This is the common meaning of the term "death rate" when used without qualification.

A *specific death rate* is a rate for a specified cause, for a specified nationality, age-group, or the like; especially one "based upon a specified or limited group of population" (U. S. Census).

A *gross, or apparent, death rate* includes all the deaths which have occurred in a given district in a given time, regardless of deaths of non-residents occurring therein.

An *actual, or true, death rate* is one from which the deaths of non-residents in local hospitals and other institutions are excluded, while deaths of residents occurring in institutions elsewhere are so far as possible included.[1]

[1] While the terms used in these two definitions are not in general or official usage, it seems desirable to adopt them for present purposes. The term "actual," while accepted in England, is not yet familiar in this country, nor is any corresponding term, because the procedure as to resident and non-resident deaths mentioned in the definition is not yet properly established here.

A *crude, or unstandardized, death rate* is one which is uncorrected for the various factors of age and sex distribution and the like, in the population, which would tend, aside from sanitary conditions, to affect mortality.

A *standardized death rate* is one in which mathematical correction is made for such factors, usually for age and sex distribution of population.[1]

A death rate may be described by more than one of the above terms. Thus, the general death rate of a city might be the actual rate, but unstandardized.

The standardizing of death rates requires a detailed statistical process which need not be described here.[2] It

It would be very desirable to have a provision of law in every state that whenever the death of a non-resident occurs in a hospital (or other institution) in any sanitary district, the local registrar should, within a limited time, make out a duplicate of the certificate and transmit the same to the local registrar of the district where the decedent was previously resident. In this way such non-resident deaths (as determined by a stated rule) could be not only subtracted from the statistics of the district where they occurred but do not belong, but they could also be added to the district where they do rightfully belong. Such correction would be made not only locally but also by the state registrar, so that all published statistics would be "actual." The law could readily be enforced by inspection of the various local records by state registration officials. Such a provision would also subserve private convenience in obtaining official data relating to residents who have died in some other municipality. Some rule should also be adopted relative to deaths of transients not in institutions. For present status of the whole matter of deaths of non-residents and transients see Appendix E, Rule No. 3 of 1908.

Since the numbers and rates published in state and Federal reports at the present time are gross rates, local reports should, in stating their general figures, give *both gross and actual.*

Similar regulations should be made for *births* in the case of non-resident mothers.

[1] Such rates are frequently called "corrected rates." The above is preferred as the term suggested by the Census (Mortality Statistics for 1911).

[2] Described in Newsholme's "Vital Statistics"; and by Wilbur, in Rosenau's "Preventive Medicine and Hygiene," 1913, p. 901. Cf. Appendix IV of Whipple's "Typhoid Fever," 1908 (reprinted from Ann. Rpt. Mass. State Bd. of Health for 1902).

is chiefly of value in comparisons between the rates for different communities, and hence is of comparatively little interest to the local health officer.

The rates published in state and Federal reports at the present time are, except as otherwise specified, gross and unstandardized.

Nevertheless, while the standardization is infrequently applied, it should constantly be borne in mind that death rates are influenced by a large number of factors, many of which have no relation to sanitary conditions. It is the net effect of these which is summed up in *the general death rate*, which therefore, while it is an important figure, *cannot, as a sanitary index, be accepted without qualification.* In fact, the general death rate may give little real indication of the sanitary situation, and it becomes necessary to consider the specific rates for various diseases, ages, etc., in order to accurately estimate health conditions. Some of the various factors involved will be taken up below.

The *general* (*annual*) *death rate* is obtained by dividing the number of deaths during the year by the estimated mid-year population in thousands for that year, so as to express the rate as "per thousand of population." Thus:

Death rate (per thousand)

$$= \frac{\text{Number of deaths during year}}{\text{Mid-year population} \div 1000}.$$

Specific death rates are calculated in a similar manner, though differently expressed. The common expression of death rates for specific causes is "per 100,000 of population" (sometimes per 10,000), as the expression of such rates "per 1000" would necessitate a clumsy use of decimals. Thus, for typhoid fever:

Typhoid fever death rate (per 100,000)

$$= \frac{\text{Typhoid fever deaths during year} \times 100}{\text{Mid-year population} \div 1000}.$$

Such a specific rate as that just given is calculated upon the whole population, but there are others which should be based upon a limited or group population. Thus, if it is desired to calculate the general death rate of a certain ward in a city the rate should be based, not upon the whole population of the city, but upon the estimated mid-year population for that particular ward. The rule is, *correspondence of figures is a prerequisite to combination.* (See also under Fallacies, p. 526.)

The **factors which determine death rates** may be summed up under three heads:

1. COMPOSITION OF POPULATION. — The nature of the population has an important influence on death rates. Some of the factors under this head are susceptible of sanitary control or mitigation; others are not. But in any case, all those mentioned in this section constitute at least initial disadvantages.

Thus, for example, in the distribution by *age* a large percentage of the very old or the very young (the latter indicated by a high birth rate) will tend to increase the general death rate. Death rates at various ages are shown in Chart 1, p. 74.[1]

In *sex* distribution the proportion of males, who experience a higher mortality at most ages, tends to increase the rate.

Certain *races*, e.g., the negro race, tend to higher death rates. In Richmond, Va., where 37 per cent of the population is colored, the negro death rate is 80 per cent higher than the white. The negro death rates for the more important causes should be shown separately.[2]

[1] The U. S. Census in its analysis of mortality has established the following sets of age-groups: (*A*) Under 1 year, 1–2, 2–3, 3–4, 4–5; under 5, five-year periods from 5 to 100, 100 and over, unknown age. (*B*) Under 1, 1–2, 2–3, 3–4, 4–5, 5–10, ten-year periods from 10 to 100, 100 and over, unknown age. See also the grouping in Table 1, p. 73. (*A*) and (*B*) are in accordance with the population classification of the Census.

[2] See Terry, "The Negro: His Relation to Public Health in the South," *Am. Jour. Pub. Health*, 1913, vol. III, no. 4, p. 300.

Ignorance and careless modes of life among the population are evidently potent factors in increasing death rates.

2. Environmental Factors not Subject to Sanitation. — Among these are to be reckoned *climate* and *weather*. Southern climates furnish the most favorable conditions for the life of disease germs in the environment, for the transmission of insect-borne diseases, make the preservation of milk and other foods difficult, and depress the vitality of some individuals. Such conditions may be counteracted by sanitation, but since they cannot be removed by it, constitute a distinct handicap. The rigorous northern climates also have their disadvantages, although, on the whole, mortality is higher the nearer the tropics are approached. Hot weather increases infant mortality through its effect upon the infant organism and upon the milk supplies, while cold weather favors pneumonia, bronchitis, and other diseases of the respiratory system. Changeable weather, and particularly rapid changes of temperature, increases the mortality through its strain on the adapting powers of the feeble, the very old, and the very young. The various communicable diseases have an incidence which varies with the season, — intestinal diseases in summer (cf. remark on typhoid fever, p. 193), respiratory and skin diseases (diphtheria, scarlet fever) in winter.[1] Health officers would do well to include in their reports some comment on local temperature and other meteorological conditions, based on official Weather Bureau data.[2] The relation between summer heat and infant mortality is particularly important. Poverty, with the accompanying lack of sufficient and nourishing food and of adequate clothing, frequently combined with alco-

[1] Cf. North, "Seasonal Diseases and Seasonal Temperatures," *Am. Jour. Pub. Health*, 1913, vol. III, no. 3, p. 322.

[2] Address the nearest local weather office, or the Weather Bureau, Department of Agriculture, Washington.

holism, is a potent adverse influence which need only be mentioned. Overwork and anxiety enter into the problem as large factors. Lack of work — "hard times" — produces an injurious poverty for some of the population, although for others it may necessitate abstinence from overwork and injurious self-indulgences,[1] for prosperity no doubt has, as well as protections and advantages, certain incidental excesses detrimental to health. On the whole, an economic condition of moderate prosperity would seem to be most conducive to low death rates.

3. SANITATION. — Under this head are to be included all the forces of public health administration as well as of sanitary works such as water-supply, sewerage, etc.

One of the adverse factors which might have been mentioned in the preceding section is *congestion of the population*. This, while an environmental state difficult of administrative modification, is the matrix of a number of sanitary evils which call for a special degree of control. Congestion, the crowding of large numbers of persons upon a small area and of families into cramped dwelling quarters, favors communication of disease, uncleanliness and inadequate ventilation; while accompanying it are commonly poverty, ignorance, low standards of intelligence and living, alcoholism and the like. These influences show statistically in infant mortality and the death rates from tuberculosis and other diseases. Hence it is that urban, or concentrated, populations present greater sanitary problems than rural, or segregated, populations.

Trades deleterious to health — some subject to great, others to little modification by sanitation — may also be mentioned as a special factor tending to increase mortality and presenting serious sanitary problems.

[1] See note, p. 92 f.

SPECIFIC MORTALITY FIGURES

From what has been said it may be seen that the interpretation of a general death rate is not an easy matter, and especially that sanitary administration may not be directly measured by it. If the various non-sanitary factors change but little from year to year the variations in the general death rate over several years may be taken as an approximate indication of sanitary conditions. If the non-sanitary factors are subject to variation, due allowance must, of course, be made. It is because of the uncertainty of these non-sanitary factors that comparisons of crude general death rates must be made with caution. Especially should comparisons of different communities (or of sections of the same community) be distrusted unless all the factors are taken into consideration.

It is for such reasons as these that study of the sanitary status of a community demands analysis of the general death rate through the use of *specific mortality figures*.[1]

The specific numbers and rates most frequently taken are according to cause of death. Other specific figures are sometimes used, as for age-groups, nationalities, occupa-

[1] A good discussion of specific causes of death and the scope and significance of the various terms is given in U. S. Mortality Statistics for 1911. In the annual reports of the Superintendent of Health of Providence, R. I. (Dr. C. V. Chapin), for 1905 and subsequent years, will also be found illuminating remarks on the various specific causes of death and the statistical relationships between them.

The establishment of a sanitary index to include the combined effect of the preventable causes of death has been proposed. (Batt, "The Establishment of a Sanitary Index Based upon Certain Specific Mortality Rates," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 2, p. 132.) Such an index would take account of communicable diseases (titles 1 to 16 of the Internat. list, excepting possibly influenza, cholera nostras and dysentery), tuberculosis (all forms) and infant mortality (under one year). It is stated that the curve for this index does not always follow the general death rate from year to year, hence the necessity for consideration of specific rates.

tions, etc., in combination with total deaths or deaths from specific causes, but on the whole the most light is obtained through consideration of causes of death.

On certificates of death as filled out by physicians, not only are thousands of different terms used in the statement of the cause of death, but these terms are subject to greater or less inaccuracies and are frequently combined in such a way as to make determination of the true cause difficult. It is the problem of the vital statistician to classify the deaths under a limited number of titles, otherwise they cannot be intelligently studied; and those titles must be as exact as scientific nomenclature can make them. The problem has fortunately been much simplified through the system known as:

The International Classification of Causes of Death. — This classification, sometimes called after its originator the "Bertillon System," is employed by the U. S. Bureau of the Census and the registration states and by all progressive registration offices and officials. An International Commission of Revision meets every ten years for the purpose of revising it, the latest revision having been made in 1909. A Manual of the International List is published by the U. S. Census Bureau, as is also a Physicians' Pocket Reference which has been distributed to all physicians in the country so that they may aid in bringing about a uniform and general use of the terms. Both of these publications may be obtained on request, and the former should be a ready reference book in use by every health officer and registrar.

In the International List all causes of death are arranged under 179 specific titles, each having a definite number and name, and only these titles are used in reporting statistics. As an example of the simplification effected: under the first title, "1. Typhoid fever," are included 33 separate terms used in death certificates to denote this disease. There is also an Abridged Classification which consists of

only 35 titles, formed by combinations of the extended list; this, however, has a comparatively limited use; the titles of the full list should be used in general tables of causes of death. It is an invariable rule that in reports *all statements and tabulations of causes of death should be strictly according to the International Classification.*

The Manual issued by the Census Office gives instructions for the assignment of deaths under the Classification which are indispensable to the registrar in making up his reports. In a third or so of death certificates two or more "causes" of death are given, and it is the task of the registrar to determine the correct title, always bearing in mind that it is the real *primary* or *underlying* cause of death, and not mere complications or terminal conditions, which is to be selected. Upon the care and skill with which this is done will depend to a great extent the value of the resultant statistics. A knowledge of pathology as well as familiarity with the International List is required for this task and the health officer if not a medical man should obtain medical advice in marking the causes of death. So far as possible individual opinion on doubtful cases should be subordinated to the rules given in connection with the use of the International List. Since this matter is fully discussed in the Manual, no further mention need be made here.

Death Rate for Specific Causes of Death. — Rates for specific causes of death may be expressed in several different ways (the first of which has already been mentioned):

(1) Per 100,000 of population. This is the commonest and most useful form of expression.

(2) As a percentage of the total mortality from all causes. Of limited and uncertain value (see p. 528).

(3) As related to certain groups of the population. For example, the percentage of tuberculosis deaths among a certain number of workers in a certain trade. This method is very valuable in special studies of occupational mortality,

solving questions which cannot be touched through more general statistics.

(4) With communicable diseases, as a percentage of the number of cases of the disease. This figure is sometimes known as the "fatality," or "case mortality," or "percentage mortality."

Expression of Infant Mortality. — The standard form of expression of infant mortality is *the ratio of deaths under one year of age per 1000 births.*[1] (Enumerations or estimates of population under one year of age are unreliable and are not considered a permissible basis for this ratio.) This figure is known specifically as the "infant mortality rate"; its employment, however, is sadly handicapped by deficiencies in the reporting of births. For this reason the Census authorities state (1911) that it is "impossible to present satisfactory rates of infant mortality for the great majority of states and cities."

The rate "deaths under five years of age per 1000 of population under five years" is also used. The percentage of deaths under one year (and under five years) based on the total deaths of all ages may be given. Deaths of infants under five years of age should be given by age as follows: by days for the first week, by weeks for the first month, by months for the first year, and by years for the five years. (See Chapter II, Child Hygiene.)

In Appendix G is indicated the statistical material which should be presented in local board of health reports. In addition to such material the health officer may make any *special studies* of the local mortality that circumstances

[1] In order to determine the infant mortality rate *exactly* it would be necessary to consider what proportion of the infants born in any one year die before reaching the age of one year, so that both births and deaths refer to the *same group;* but as the number of births does not usually vary too greatly from year to year it is more practical to divide the deaths by the births for the *same year*, as implied in the definition.

render desirable, consisting in statistical investigation, or, perhaps more often, illuminating comment upon the local statistics.

Errors in Death Certificates. — Statistics being no more accurate than the original data from which they are drawn, registrars should be vigilant in obtaining complete and, so far as may be ascertained by inspection, accurate certificates. The United States Standard Certificate of Death is now widely used throughout the country.[1] It contains twenty numbered items, eleven of which are of statistical interest, the remainder being only of legal or personal value. Special attention should be paid to items 7 (age), 8 (occupation) and 17 (cause of death). In the last instance the spaces for primary and secondary (contributory) causes of death should be as exactly filled out as the physician's knowledge of the case allows; and where there is uncertainty in the assignment of the certificate under the International List of Causes it may be desirable to obtain fuller information from the physician. (Cf. the note on the reverse of the certificate.) Under item 18 (length of residence), care should be taken that this space is filled in case the death occurs in a hospital or other institution; and in such instances the "former or usual residence" is to be given by place if out-of-town and by street and number if local. Only thus can deaths of non-residents in institutions be separated and deaths of residents in such institutions be assigned to their proper wards, both of which procedures are necessary for obtaining "actual" death rates as has already been described.

Relation Between Birth and Death Rates. — On the whole, a high birth rate tends to produce a high death

[1] A discussion of its points is given by Dr. Wilbur, formerly of the Census Bureau, in Rosenau's "Preventive Medicine and Hygiene," 1913, p. 883. Copies of the certificate may be obtained on application to the Bureau of the Census, Washington.

rate. This is due to the influence, through the larger number of infant deaths in proportion to the population, of the higher infant mortality occurring in the congested districts where the birth rate is high. This would not, however, be the effect if infant mortality were so limited by hygienic measures that the proportion of vigorous persons of child-productive age counterbalanced or outweighed the number of infants dying. A high birth rate may, therefore, sometimes be taken as an explanation, though never as a justification of a high death rate.

In some communities the phenomena of a lowered birth rate (due to later marriages, voluntary limitation of families, etc.) and a lowered death rate (due to improved hygiene) go hand in hand.

How Far may Death Rates be Lowered? — It is an interesting question to just what point the general death rate can be lowered in any community. It is clear that even if all causes of death except old age were eliminated, there would still be a *limit* to the reduction.

As a general proposition, the level toward which the death rate would sink as sanitary measures became more and more effective would be determined by the amount of mortality from *non-preventable* causes, i.e., roughly constitutional disease, accidents, and old age. In any given community the actual amount of such mortality would depend upon the composition of the population according to age, sex, race, and upon environmental factors not subject to sanitary control (see p. 510 f.). These vary greatly from one community to another. In one community the sum total of such factors might produce an irreducible minimum death rate of 8 per thousand; in another, having greater natural problems, it would be higher. The factors often vary in the same community from year to year.

We must repeat that the absolute level of the general death rate considered by itself, being the resultant of many factors both sanitary and non-sanitary, cannot be taken

without analysis as an accurate gage of sanitary administration alone. Of course, certain rough ideas may be formed. If the rate is very low, say below 12 per thousand, there is a presumption that there are peculiarly favorable conditions (e.g., as to ages) in the population. If the rate is very high, say above 20, there is the presumption that the mortality from infant mortality, tuberculosis or other causes is excessive. But such general presumptions are of little value; detailed knowledge of specific death rates and all-important external factors is demanded. Such knowledge will throw light upon the amount of *preventable* mortality. Then, the reduction of this to zero, rather than any calculated effect upon the general death rate, is the true goal.

MARRIAGES

There is little in marriage statistics to interest the health officer. The principal figure is the annual *marriage rate* which is calculated in the same way as the death rate, as "marriages per thousand of population." Some authorities prefer to give the rate as "persons married per thousand of population," but this form has not come into very general use. In many states a license (the local registrar usually being the licensing official) is required for marriages in order that marriages contrary to the provisions of the law shall not take place. This requirement incidentally improves the registration of marriages by making it an easy matter to check them up.

On account of their legal importance care should be taken to secure full and accurate registration of marriages.

BIRTHS

Value of Birth Records. — In spite of the great legal and statistical importance of birth records, the standard of registration in the United States is much below what it should be. Deficiencies in reporting by physicians are due

not merely to lack of realization of the value of the records but also, more especially, to the failure of registrars to point out that value and insist upon prompt and complete registration.

There is hardly a relation in life from the cradle to the grave in which such a record may not prove to be of the greatest value. For example, in the matter of descent; in the relations of guardians and wards; in the disabilities of minors; in the administration of estates; the settlement of insurance and pensions; the requirements of foreign countries in matters of residence, marriage, and legacies; in marriage in our own country; in voting and in jury and militia service; in the right to admission and practice in the professions and many public offices; in the enforcement of laws relating to education and to child labor, as well as to various matters in the Criminal Code — the irresponsibility of children under ten for crime or misdemeanor, and determination of the "age of consent," etc. As the country becomes more densely settled and the struggle for existence sharper, many of these matters, which have hitherto been of minor significance, will take on a deeper meaning and acquire greater importance.[1]

The chief statistical use of birth records lies in their being the indispensable basis for studies of child life and particularly of infant mortality. The calculation of the "infant mortality rate" depends directly upon a complete registration of births, and if that registration is materially impaired the rate based upon it is of little or no significance. "What do we know about infant mortality, which we are all so anxious to prevent," asks Dr. Wilbur of the Census Bureau, "when not a single State or city in the United States has the data for a correct statement? It depends upon the accurate registration of *all* births." It is to be hoped that through the efforts of health officers and registrars this reproach will soon be removed as it can be if registration laws are simply strictly enforced.

[1] Dr. F. W. Reilly, quoted in "Birth Registration," Monograph No. 1, Federal Children's Bureau, U. S. Dept. of Labor, 1913, which contains an important practical discussion of the birth registration problem. (Cf. pamphlet, "Why Should Births and Deaths be Registered?", published by Am. Med. Assn., 535 Dearborn Ave., Chicago.)

Registration Methods. — A special effort should be made to obtain *prompt* returns. Here, as elsewhere, a return postponed is not infrequently a return neglected. Legal provision should be made (as is the case in some states) that the given name of the child may be registered by means of a report supplementary to the regular return, so that there is no necessity for delaying the latter on account of delay in naming the child. In such case the registrar should systematically follow up the cause of unnamed infants and obtain the supplementary return, for from the legal standpoint registration of the full name is most important. The time limit for birth reporting varies in the different states. The "model law" of the Children's Bureau specifies ten days, which is certainly ample. Prompt reports are required primarily for the sake of infant hygiene work and prevention of blindness. A very effective plan consists in requiring "notification" of the birth within 36 hours, this to consist simply of a statement of name, address, and date and time of birth, to be followed later by complete "registration." The registrar could easily see that the latter was done in all cases. Of 36-hour notification in England, it has been said that no other one expedient has done so much toward lessening infant mortality in that country. A statute of Massachusetts (Chapter 280, Acts of 1912) requires notification within 48 hours, with registration in full within two weeks.[1]

Birth Rates. — The birth rate is calculated in precisely the same manner as the general death rate, being expressed as births per thousand of population. If all the births that have occurred in the district during the year are included, the rate is, strictly speaking, a "gross" or apparent rate. In order to obtain the actual rate it is necessary to exclude the births of infants born in local hospitals

[1] In Montclair, N. J., midwives are required to notify the health office by telephone or telegraph immediately after being called to attend a confinement.

to non-resident parents, just as non-resident institutional deaths are cast out of the death rate.[1] Unfortunately the data for separating such "non-resident" births do not appear upon the standard form of birth certificate, but the necessary information may be obtained from hospital records at the close of the year (when it should be the custom to check over such records to ascertain that all hospital births have been reported). Local reports should publish *both the gross and the actual* total numbers and rates, though only the actual resident births need be included in detailed tabulations. For the non-residents, however, a statement should be given of the places of residence.

Birth Certificates. — The United States Standard Certificate of Birth,[2] approved by the Bureau of the Census, now adopted in substance in many of the States, contains, like the Standard Death Certificate, items both of legal and of statistical value. Of these 23 items, the most important to the vital statistician are: place of birth, including address; date of birth; color, or race, and birthplace of father; and same items for mother. Some forms of certificate include a question as to the use of prophylactic solution for the prevention of blindness in the newborn, mainly as a reminder to the physician or midwife that this treatment should be applied in all cases. The Massachusetts certificate bears a statement of the law requiring reporting of ophthalmia neonatorum, and also requires the physician to state whether or not he personally attended the birth, it being a practice in some instances for physicians to sign certificates for midwives.

Birth certificates should be examined, at time of filling, for accuracy and completeness, though not so much subject to error as death certificates.

[1] Properly, all births by non-resident mothers, whether or not in hospitals, should be separated. The remarks regarding non-resident deaths (p. 507 f.) apply in substance to non-resident births.

[2] Copies of this certificate may be obtained from the Census Bureau, Washington.

STILLBIRTHS

The one important statistical consideration here is that *figures for stillbirths must invariably be kept separate and distinct from those of births and deaths, not being included in either.* It is sometimes unfortunately impossible to determine whether some published tables of births and deaths are inclusive or exclusive of stillbirths. Therefore, general tables of births and deaths should always bear the statement "stillbirths excluded." There is little in the way of statistical work in connection with stillbirths, and a brief statement by causes (so far as these are stated) is all that need usually be given. More light on the exact causes and prevention of stillbirths is needed.

For definition of stillbirth and rules regarding stillbirths see Rules of Statistical Practice of the American Public Health Association (Appendix E).

MORBIDITY STATISTICS

Under the head of communicable diseases we have mentioned morbidity statistics, i.e., statistics of disease. There is this disadvantage in dealing with morbidity figures: that they are neither so full nor so accurate as those of deaths. Nevertheless, with improved methods of diagnosis and more extended recognition and reporting of the various diseases, this department of statistical science will doubtless receive in future more attention than at present. Recent developments have brought about a demand for reports of diseases of occupation and of epilepsy, feeble-mindedness, and the like, and these are now required by law in certain states. The same may be said of the statistics of accidents and disabilities, incurred in industry, and of statistics relating to housing, health and industry, and other related social problems, to which ever increasing attention is being directed.

Morbidity statistics, we may note in passing, are not

considered under the head of vital statistics in the usual sense.

SOURCES OF STATISTICAL ERROR

Perhaps no other science holds so many pitfalls for the unwary nor offers so many hidden liabilities to producing false results as statistics. Traditional popular distrust, which unfortunately has some foundation in the careless and prejudiced uses to which figures are not infrequently put, should be disarmed by care and frankness in the use of statistical data on the part of the health officer.

The sources of statistical inaccuracy may in general be put down under three heads: (1) mistakes, (2) errors and (3) fallacies.

1. **Mistakes.** — Under this head we include mistakes in counting and copying, arithmetical mistakes, misprints and the like, in the clerical work of statistics. Such are not to be tolerated in statistical work, though, to be sure, they may creep in where masses of such work are performed. They must, therefore, always be guarded against. The critical reader may compare figures given in different statements or tabulations in the same report to see if they agree in their common quantities. Those who compose statistics should make use of all feasible checks, such as are suggested in this chapter, under "Methods."

2. **Errors.** — By errors (as distinct from mistakes or blunders) we mean those inaccuracies which are inherent to a greater or less extent in even the most careful statistical work. Practical statistics is not an exact mathematical science, for it is occupied in dealing with variable quantities which can rarely be exactly measured. Its natural errors must be accepted, care being taken to see that they do not materially impair the practical value of the figures.

Some of the sources of ordinary statistical error are the following:

(*a*) In the *original data* taken from certificates, office records, etc., which are subject to certain inaccuracies and are sometimes incomplete. We have already referred to matters of this nature in the paragraphs on birth and death certificates above.

(*b*) *Lack of "correction" or standardization* in numbers and rates. The objects and principles of such correction have already been referred to (p. 508 f.), and while it is not usually feasible to "correct" rates, nevertheless, comment should be made to show the nature of the allowances which should be made. When the need of correction is entirely overlooked and produces serious error it partakes of the nature of a fallacy (see below, False Comparisons).

(*c*) The use of *too few data*. It is a well-recognized statistical principle that the smaller the number of unit cases taken the greater is the relative error involved in variations.

For an extreme example, the writer, in studying the typhoid fever death rates of Massachusetts towns, found that a certain town had a death rate in a certain year which was twice as great as it was the year before, and that both rates appeared to be very excessive, one being 40 and the other 80 per 100,000. But on examining into the matter it was found that the town had only 2500 population and that there had been a difference of but one death between the two years, the deaths for the two years having been 1 and 2 respectively. The difference of *1* death had made the astounding change of *40* (per 100,000) in the rate. Further investigation showed that in many other years there had been no typhoid fever deaths whatever, the rate in those years being, therefore, zero. In order to determine whether the typhoid fever death rate of that small town was really excessive or whether it was increased fortuitously, so to speak, by the occurrence of two or three cases of possibly outside origin, it would be necessary to take the average rate over a series of years, and thereby obtain a large enough number of deaths to be statistically indicative.

And a consideration of the numbers of *cases*, which are about ten times as numerous as typhoid deaths, would, if knowledge of all cases could be obtained, give a far better indication. Of course, really well-marked outbreaks in single years would be another matter.

Statistical theory proves that by increasing the number of observations, the accuracy increases as the square root of that number. In other words, the average of 16 cases or observations would be subject to but half the error incident to an average of 4. Just how numerous the data should be to warrant reliance is a matter for determination in individual instances. In general, it must be considered how great an effect variations ordinarily to be expected would have upon the final statistical results.

The estimation of error is an important part of statistical work, and in advance statistics various methods of calculating numerical error are used. But in local health statistics a careful examination of the figures and their possible sources of error should suffice to ensure freedom from errors of such magnitude as would practically impair the results.

3. **Fallacies.** — By a fallacy is meant an illogical assumption or process which results not merely in estimable error but in an essentially false conclusion. Subtle fallacies may be unconsciously established, but the more common are recognized by all statisticians. They may consist in:

(*a*) The use of *absolute numbers* instead of relative numbers and rates.

(*b*) Failure to define *terms*, and the false use of terms. Statistical terms having a commonly accepted meaning should be used only in that sense, and others should be clearly defined.

(*c*) Use of *irrational ratios and combinations*. Common-sense and observance of the rule, correspondence of figures — a prerequisite to combinations — usually serve to avoid

this pitfall, the nature of which is illustrated by the following extract from a recent editorial in the *New York Times:*

> The mortality figures recently published by the Census Bureau have been interpreted in some quarters to prove that a man is past his prime at forty years. A careful examination of the figures themselves shows that this conclusion is utterly unwarranted. The specific death rates, corrected for age and sex, indicate that, in 1911, 14.5 persons died among every thousand males between the ages of 35 and 44, while the death rate for women of the same age was only 10. Between the ages of 45 and 54 the specific death rate was 23.3 for every thousand men and 16.2 for every thousand women. Certain alarmists have added together these specific death rates in the attempt to show that the mortality between the ages of 35 and 54 is 63 per thousand of population. Statisticians know very well that specific rates cannot be added in this way, and conclusions based on such crude and ignorant manipulation of government figures need occasion no anxiety.

The principle has an important bearing in occupational and other statistics which should have a specific basis. A statement, for example, that the tuberculosis death rate among the employees in a certain industry, say hatting, is 150 per 100,000 as compared with a rate among teamsters of 50 is valueless if based upon the general population, for we do not know the relative total numbers of hatters and of teamsters. The incidence in a certain group should be based upon the total number of employees in that group, to be expressed in the form of rational rates as "annual deaths per 1000 of hatters," and the like. (See also remarks on calculation of specific rates, p. 515.)

(*d*) *Fallacious Comparisons.* — Perhaps the most common statistical fallacy lies in the making of comparisons which are false because of failure to analyze the quantities compared. An example will illustrate. Several years ago a statement of the death rate in the United States Army in the Philippines was made, calling attention to the lowness of this rate as compared with that of most American cities. The fallacy lay in the failure to add that since the army of occupation was composed of vigorous men in the prime of

life, it would not be predisposed, apart from sanitary conditions, to nearly as high a death rate as prevails in the ordinary city. It may be that the sanitation was better, but the unqualified statement did not prove the point; this only a study of "corrected" rates could do.

Again, cities with a young and vigorous population cannot be compared, without correction, with older cities having a less favorable age distribution. Places, furthermore, which are health resorts attracting advanced invalids will, aside from sanitary conditions, have a high death rate, in the interpretation of which allowance should be made for the deaths of persons who are virtually non-residents.

The making of comparisons by the use of the "ratio of deaths [from a certain cause, or in a certain age-period] to total deaths" is unsound. Obviously, such ratios will vary greatly with the actual number of total deaths and with the composition of the population. Specific rates based upon total or group population afford the proper basis for such comparisons.

The rule to be followed in making statistical comparisons is that the quantities to be compared must be so based or corrected as to be substantially comparable in respect to the point at issue. In the ideal comparison all conditions on both sides would be the same except the one upon which the comparison is to be made.

(*e*) The rough use of averages and other *general figures* without reference to conditions in detail; a point which has already been dwelt upon.[1]

(*f*) The common fallacy of *post hoc reasoning*, not of course confined to statistical study, according to which if a certain phenomenon which we call A is followed by a certain phenomenon which we call B, B is erroneously supposed to be necessarily due to A. Thus it was formerly thought that disinfection of clothing and other fomites was effective in checking yellow fever because epidemics

[1] P. 501 f. Also Quetelet's third rule, footnote to p. 538.

happened to die out after such disinfection had been performed; we now know that fomites have nothing to do with its transmission. As Whipple truly says: "This and other fallacies are very likely to creep in unawares in statistical work under cover of apparent accuracy and thoroughness of investigation implied by the use of long columns of figures." And he adds this remark applicable to statistical investigation in general:

> Bailey has well said that the phrase, "Other things being equal," has covered up a multitude of sins. As a rule, the other things are not equal. He also warns against the hidden errors that may lie in the use of the terms, "It is undoubtedly true that," and "It is probable in this case that . . . ." Of great importance is it, therefore, to make sure that the data collected are sufficient in kind and number for the purpose for which the statistics are intended. No better preparation for the work of the statistician can be had than that given in a course of study in formal logic. . . . First of all vital statistics must be used with truth.[1]

STATISTICAL METHODS

Assuming that a reliable registration has been obtained and a proper system of recording established, and that there has been mapped out a scheme of tabulations to be made, the question arises: What are the best practical methods for obtaining the results contemplated? This is a question of clerical system and technique which will naturally be worked out in each office and for which few details can here be laid down.

Tabulation Systems. — In devising methods of tabulation two requirements should be kept in mind: first and chiefly, avoidance or correction of mistakes; and second, convenience and speed. Since it is difficult to avoid some mistakes in the first working of masses of data, the detection and rectification of mistakes after the tabulation is made and before it is approved is a most practical and necessary requirement, and methods should be chosen with this object chiefly in view. In making tabulations from

[1] *Op. cit.*, p. 491 *supra.*

the original vital records it is the usual practice to make a direct tally from these records. To illustrate: suppose that a tabulation by causes is to be made from a number of death records. It is assumed that the records have previously been gone over and each death marked with the International List number to which it is assigned (see p. 514 f.). A large sheet is prepared with spaces marked off for each cause (sub-spaces for age, sex, etc., if desired). The data are then read off and for each cause a mark is placed in the appropriate space. Every fifth mark is made diagonally across the other four, so that it is very easy at the completion of the tabulation to count up the totals. The method is simple, but has certain disadvantages, such as: difficulty in quickly locating the spaces on a large sheet and the liability to mistake in so doing, inconvenience and liability to mistake in making corrections, the tendency of spaces to become cramped, and possibility of losing the place in case of interruption.

For such reasons the writer has adopted another method of making tabulations which, though indirect, appears to be somewhat more convenient and less liable to mistakes. This consists in working with dummy certificates made from the original records. Suppose, for example, that the above tabulation of deaths is to be made by this method. The death certificates having been marked with the International numbers for causes, then, with one person reading and another marking (an arrangement which is more rapid and safer than individual work), a dummy memorandum is made for each certificate, bearing the desired data in the form of abbreviations such as the following:

Cause of death: by International number.
Sex: *m* or *f*.
Color: *w* or *c*.
Age: exact number or by age period.
Residence (for institutional deaths): *r* (resident), *nr* (non-resident). (Wards may also be given for all resident deaths if desired, with any other data required for tabulation.)

A dummy memorandum containing the above items would look something like this:

Data

No. of Records, *324*.
Cause of death, *128*.
Resident.
Male.
Age, *25*.
White.

Dummy

324	128	r
m	25	w

The number appearing in the upper left-hand corner is the number of the original record, to which it is thus easy to refer back in case of question or need of additional data. The data are always placed in the same relative positions on the card, there being space in the example given to add any other data desired. For making the dummies it is convenient to use cards about 3 x 4 inches of about the same stiffness and weight as used in card indexes. Paper slips are undesirable as being very difficult to handle. Both sides of the card may readily be used.

When the cards have been made, tabulation is a rapid and simple process of sorting and counting, with these advantages: that any desired combinations can readily be made, that the studies may be extended or modified in any direction, that in the process of counting the accuracy of the sorting may be verified, that if the totals do not come out correctly the error can readily be found. The flexibility of the method, combined with non-liability to serious error, is its chief recommendation. Care should be had to transcribe on the cards at the start all data which are to be used, for it is inconvenient, though possible, to re-sort and add data afterwards.

In working with large tables the frequent use of the ruler is recommended. One of the sources of statistical mistake is confusion of columns. The eye finds it particularly difficult to follow through a long horizontal row, but if a straight-edge be laid on the sheet or page, ease and accuracy are obtained. This applies particularly to the

abstraction of figures from extensive tables such as those of the Census, where the figures are small and the rows and columns long. In tabular work the ruler is as indispensable as the pencil.

METHODS OF COMPUTATION. — The arithmetical operations required in statistics may be performed in the usual manner, although, where many operations of multiplication or division are to be performed the engineer's slide rule may be found useful. The use of this instrument can readily be learned without special mathematical knowledge, and with it ratios may very quickly be found to a precision of about 1 in 500 (higher with the larger sizes).[1]

Methods of Checking. — No statistical results should be utilized or published which have not been verified by reasonable and appropriate checks. The following are general methods which may be used:

(1) *Automatic Checks.* — In some instances an automatic check on a series of numbers may be obtained by addition or otherwise. An example of this may be found in the population estimates given on p. 505.

(2) *Repeating.* — A calculation may be checked by simply repeating it. In order to avoid repeating mistakes in method or arithmetic, it is desirable that if possible the re-calculation be performed by a second person, or at any rate at another time when the original details are not too vividly in mind.

(3) *Use of Alternative Methods and Sources.* — A useful check on many figures consists in approximation obtained through mental calculation. Suppose, for example, the percentage ratio $\frac{74}{350}$ is to be calculated. A glance at the figures shows that the desired result will be something over 20 per cent (since $\frac{70}{350}$ would be exactly 20 per cent), and apparently not far from 21 per cent. Exact calculation

[1] Discussion of tabulating, adding and multiplying machines and methods in use in large statistical offices is beyond the scope of this manual.

shows the correct figure to be 21.1 per cent. Such mental calculation made before the exact calculation prevents gross mistakes, especially such as would be the result of putting the decimal point in the wrong place, and for some figures it may be a sufficient check.

Where calculations have been performed by the regular arithmetical processes, the slide rule (see above) is a useful check.

In tables, both the columns (vertical) and the rows (horizontal) should be added; a check on additions may then be obtained by seeing that the grand total obtained by adding vertically is the same as that obtained by adding horizontally. In the following example:

	Col. 1	Col. 2	Col. 3	Total
Row 1	8	7	2	17
Row 2	5	4	6	15
Row 3	2	3	1	6
Total	15	14	9	38 = Grand total

the figure 38, being the sum of *both* the vertical and horizontal totals, checks all additions in the table.

Care should be taken that corresponding figures appearing in different tables be checked against each other. It is confusing and discouraging to consult a report and find, say, 80 deaths from pulmonary tuberculosis given in the general mortality table and only 70 in the section on communicable disease, without a hint as to any reason for the discrepancy.

Certain graphic checks may sometimes be made use of. Thus a plot may disclose variations which do not so distinctly appear in columns of figures.

Deficiencies in Data. — All large masses of data are subject to deficiencies; that is, in some of the individual cases the facts, even with the greatest care in registration, will not be completely known. Thus in any given tabu-

lation there may be some facts which must be classified as "unknown" or "not stated." If these are very few in number they will not substantially impair the value of the tabulation. It is bad practice to endeavor to eliminate the figure for unknowns by distributing it, as is sometimes done, among the other items. It should always be separately stated, giving thus a measure of the residual deficiencies which remain after the data have been made as nearly complete as possible.

PRESENTATION OF RESULTS

The effective presentation of statistical results in written or published reports, through the spoken word, in charts, exhibits, etc., is evidently of the greatest practical importance. Two principles apply here: first, that the presentation should be *truthful;* second, that it should be *impressive.*

In general there are two methods of presenting statistical results: the numeric and the graphic. The first of these deals with numerical statements and tables, the second with plots, diagrams, charts, maps and the like. Both ways have their uses, and it is even frequently desirable to repeat results, so as to make them clearer and more impressive, in two or more different ways. Some minds are more readily appealed to through columns of figures, statements of ratios and the like, and others through the lines of a diagram.

1. **Statements and Tables.** — Tables should contain all needed data and no more. This statement seems obvious, yet reports are published containing many pages of detailed statistics which are of no apparent practical value, the same reports omitting simple tabulations which are indispensable in any report. At the present time there are great divergencies in the content and form of statistical health reports, a situation which fortunately seems likely to be remedied through the adoption of *uniform tables* for the more important purposes. (Cf. Chapter VIII.)

In line with the principle for presentation of tables is one for presentation of figures: *figures should be presented with adequate precision but without unwarranted refinements.* Further, the degree of precision should be evident from the way in which the figure is stated. In this way a factitious appearance of great precision is avoided. To illustrate: in a population of 8000 there occur 117 deaths in a year. Computing the death rate we obtain the figure 14.625 per 1000. How many digits after the decimal point are to be used in expressing the result? Now the smallest possible change, i.e., one death, would make a difference of one part in 117 in the computed rate. Hence as we express the rate to one part in 146, i.e., as 14.6, we have done all that the figures warrant. Expressing it as 14.62 would indicate an accuracy of one part in 1462 which is not warranted by the figures, the last digit not being "significant," and to do so would be to add a useless digit and to indicate a degree of precision which does not exist in the data taken. One to 146 is of course a greater degree of precision than 1 to 117, but we should not drop the 6 in 14.6 and call the figure 15, for then the accuracy would be only 1 to 15. The *rule* would be to express this result to an accuracy of between 1 to *117* and 1 to *1170* (which is fulfilled when the result is stated as 1 to 146 — 1 to 15 and 1 to 1462 being outside the limits), and in all such cases the same principle applies.

The degree of precision is determined by the least precise quantity in the data. In the above example it has been assumed that the death figure is less precise than the population figure, although in such cases usually the population is an estimated figure not more precise than the deaths — probably not as much so. However, in case of doubt we are justified in expressing the result to a figure that will certainly do justice to the data.

In dropping digits the nearer figure should be taken for the last digit retained according to whether the one follow-

ing is more or less than 5. 14.64 would become 14.6, while 14.66 would become 14.7, the dividing line being 14.65. If the figure is 14.65, it may be so given, or it may be called 14.6 or 14.7, or, if necessary for the sake of accuracy, it may be worked out to the next place to determine whether greater or less than exactly 14.65, — according to whatever rule is adopted.

2. **Graphic Presentation.** — We refer here to the use of diagrams, charts, maps, etc. In most plots quantities, instead of being represented by numbers, are represented by distances laid off to a certain scale. In this way their magnitudes and relations can frequently be apprehended much more readily than from the figures. The tables and figures may give all the data that are needed and must always appear, but appropriate diagrams make their import more striking. Consequently extensive health reports frequently include diagrams.

There are a number of forms of diagrams, employing lines, bars, blocks, circles, etc. (for some examples see the charts in the present volume). Diagrams in two dimensions, showing how one quantity varies in relation to another, are known as "curves" (see Chart 1, p. 74). For percentages of a total the circle (see Chart 4, p. 301) is convenient, the requisite number of degrees being laid off for each quantity.

Diagrams intended for reproduction by printing should be drawn on a large scale — preferably twice or more times as large as the final plate is designed to be, in strong or even coarse lines; in the reproduction process minor blemishes disappear and the lines appear much finer in the resulting "zinc etching" or "line cut," as the engraving is called. Such cuts are not expensive. Large size charts used for public exhibitions and the like are readily reduced to any desired size.

In the preparation of charts (unless a draughtsman or sign-painter be employed) time may be saved and neatness

gained by the use of gummed letters, which may be obtained in $\frac{1}{4}$, $\frac{1}{2}$, 1 inch and larger sizes in black, white, or red through any stationer or directly from the Tablet and Ticket Company of New York.

In laying off scales it will be found convenient to make use of an "engineer's scale," which has six different sizes of scales.

It is frequently desirable to have charts drawn by an architect's or engineer's draughtsman, under careful direction, and the preparation of placards and the like not demanding accuracy in detail by a professional sign-painter.

In style, charts of all kinds should be simple, clear and striking, without ornament or exaggeration.

Maps are frequently of value, especially in the office, use being made of colors, pins, spots and the like. The "spot map" for contagious diseases, deaths, etc., is of this nature. The short tacks having heads of various colors, known to the stationer as "routing tacks," are useful for such purposes.

Titles. — No point is more important and none so frequently neglected in the presentation of statistical data as the use of full and clear titles, both to tables and to charts. Too often important comparisons are made impossible by the failure to state just what a table contains, or how it is composed, or what its purpose is. Tables of births and deaths, for example, should always bear in the title a statement that stillbirths are (as they should be) excluded, what exclusions are made (if any) and the like. An overfull title is far better than a too scanty one. A study of the titles used in the mortality bulletins of the U. S. Census will be illustrative of "good form." Similar rules apply to diagrams, which also should bear a statement as to what tables they are based upon. The sources of figures which are not of local composition, such as census figures, should be stated. Where population figures are given their exact nature should be described: whether census enumeration

or estimate, and if the latter, the method of estimation. Estimates made (as they should be) for the middle of the year are to be described as "estimated mid-year population." All special terms used should be clearly defined or indicated. In short, there should be no question as to basis, terms or methods.

Criticism and Interpretation. — Statistics are only half a report. Their significance must be brought out by discussion, by criticism and interpretation.

The best form of criticism is a discussion of deficiencies and their remedies. Nothing so clearly marks a good statistical report as a frank appraisal of the figures for what they are. The statistician's own estimate of the degree of trustworthiness of the results is in fact a necessary preliminary to a thorough consideration of the evidence set forth.

As to interpretation, there must be freedom of bias as to the conclusions to be drawn.[1] Erroneous conclusions and uses of figures are sure to react sooner or later, and frankness, be the results favorable or otherwise, is the best policy in the long run.

For those who have to study the reports from various places it may be added that, aside from arithmetical mistakes, the chief deficiencies in local statistics are: failure to define methods and terms, lack of comparability with

[1] The first of the four rules laid down by the eminent statistician, Quetelet, was:

"1. Never to have preconceived ideas as to what the figures are to prove."

The others are as follows:

"2. Never reject a number which seems contrary to what you might expect, merely because it departs a good deal from the apparent average.

"3. Be careful to weigh and record *all* the possible causes of an event, and do not attribute to one what is really the result of the combination of several.

"4. Never compare data which have nothing in common."

(As given by Newsholme, "Vital Statistics.")

figures from other places (or sometimes even with figures from the same place at different times), and failure to give all of the essential figures demanded. Locally published death rates should be confirmed by comparison with the rates published by State and Federal authorities. Sometimes, too, through comparisons among the tables in the same report internal discrepancies may be discovered.

The compilation of vital statistics can be manipulated in many ways, and by over-estimates of population or exclusion of deaths for various reasons the death rates may be, apparently, reduced so that boastful claims of the 'healthiest city' may seem to be justified. Such claims are usually open to question, and frequently will be found to depend either upon grave deficiencies in registration, the unjustifiable omission of certain deaths, over-estimates of population, or, perhaps most frequently of all, the utter ignoring or lack of knowledge of the fact that general or crude death rates are unreliable criteria of sanitary efficiency, and that the age, sex, or other peculiar constitution of the population must be taken into consideration.[1]

State reports differ so much that no general comment can be made. Statistics so published must be judged partly on such internal evidence as can be gleaned from a critical study of the figures, partly by comparison with Federal figures, and partly on the estimation of the Federal Census Bureau, which classifies those states from which the returns are considered sufficiently trustworthy as "registration states."

THE PRACTICAL APPLICATION OF VITAL STATISTICS

It is unfortunate that to many persons, including many health officers, vital statistics are looked upon as intangible calculation apart from practical endeavor — as historical facts to be placed on file rather than the impetus to health work in the living present. The following experience,

[1] Wilbur in Rosenau's "Preventive Medicine and Hygiene," 1913, p. 875.

which, it is to be hoped, is an extreme instance, illustrates the intensely practical nature of vital statistics when properly applied.

In the summer of 1910, I was invited by a board of county commissioners and board of aldermen to visit their county town and inspect a small collection of water on the outskirts of the town that was supposed to be responsible for a large amount of their sickness. After looking over the pond in the morning and making a general sanitary survey of the town, I walked over to the local registrar's office to see how many people were dying and what they were dying from. At five o'clock I consulted with the board of aldermen, several physicians, and health officers and others. I called their attention to the fact that the small collection of water was but one very small item for consideration in their health situation; that malaria had caused very few deaths in their town, and it was doubtful if the pond had much to do with their malaria as there were so many other breeding places for mosquitoes; that with a little ditching and kerosene oil (I went into details), the pond could be dismissed as a health menace; that whereas the pond was of little consequence, other conditions of health in their city were of grave consequence; that, taking statistics from their own official, they had a death rate of 27.5 per thousand which meant 12.5 people out of every thousand of their population died in excess of the average death rate that obtained throughout the United States; that for four thousand population this meant an annual unnecessary loss of fifty lives to their town; that even if they had a death rate of fifteen some of the fifteen would be from preventable diseases and, therefore, the fifty lives lost must necessarily be regarded as *excessive* preventable deaths; that their records showed a death rate from tuberculosis of three hundred and seventeen per one hundred thousand instead of the average of one hundred sixty-seven; that their records showed a death rate from typhoid of seven and one-half times the average; that during the last winter their town had had its share of deaths from measles for sixty years; that this last fact meant one of two things; either an extremely malignant epidemic or more probably inefficient quarantine; that they were most inconsistent in having required a railroad that passed through the town to build an overhead bridge at a cost of $18,000 because during ten years the railroad had killed, at a crossing, as many as ten people; that the interest on the original investment of the railroad, and the wear and tear of the bridge, would amount to at least $1,500 per year, which they were forcing the railroad to spend to prevent one needless death; that while they were requiring the railroad to spend this amount to prevent *one* death, they, the aldermen, were spending only $150 to prevent *fifty* deaths . . .

Since that visit, and, I believe, largely as a result of that visit, that town and county have taken an unusual interest in public health work . . .
There are many people who will become enthused over generalities, but the practical, cool heads that we usually find dictating municipal policies are men who want facts, and the only way to reach this necessary influence in bringing about sanitary reforms is through vital statistics. . . . As some one has said, they are the chart and compass of the sanitarian and he who attempts sanitary campaigns and neglects vital statistics will sooner or later find himself lost in a sea of generalities.[1]

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The reports of the Registrar-General of England, besides containing English and International data, are highly instructive.

[1] Rankin, "The Practical Value of Vital Statistics in the South," *Am. Jour. Pub. Health*, 1913, vol. III, no. 5, p. 453.

CHAPTER X

PUBLICITY

No phase of public health work in recent years is more striking than the movement for popular education in matters of hygiene. Not only, in the Earl of Derby's phrase, is "sanitary instruction even more important than sanitary legislation," but, under the conditions of a democracy, neither legislation, funds, nor public coöperation can be obtained, nor will sanitary regulations be thoroughly effective, without it. The term "instruction" might well be taken to include in a broad sense the general teaching in schools and colleges, the technical training of public health officers and experts, and publicity for the instruction of the general public. It is the last, however, that will here be specially discussed.

Objects. — All sanitary education of any kind has as its object one or both of two things: the improvement of personal hygiene, and the support of the administration of public hygiene. With both of these the health officer is concerned, but more immediately with the latter. When an adequate support of public measures shall have been secured health authorities can then turn their attention more particularly to the longer educative process of improving the habits of the people. Publicity, with such an immediate object, then, is

> . . . the indispensable preliminary of legislation and the necessary accompaniment of effective administrative control. It is here that many of our health administrations fail lamentably. It is doubtful if there is any department of our State and municipal governments whose aims and methods are less understood by the public than the depart-

ment of health. It is apt to be viewed with suspicion and antagonism by physicians, and with apathy and neglect by the laity.

Particularly in smaller communities failure to act by the health authorities is explained by lack of public support. The fault is often, if not usually, that of the department itself. The public is not taken into its confidence, and we see on every hand the discouraging spectacle of the health officer plodding slowly behind, instead of leading and stimulating his local public opinion. An organized system of publicity should be in operation in every health office in the country. Wherever intelligently tried, whether in the greater cities or in towns of smaller population, the results are always worth while.[1]

The foundations of sanitary education are naturally laid in the home and the school. With these, however, the health officer has little to do. The selection of textbooks on hygiene to be used in the schools is a matter for the educational authorities, though it might sometimes be wished that the health officer were more often consulted in regard to them. Fortunately, well-balanced school hygienes are now readily to be had. Health mottoes, and even "jingles" embodying single precepts, may also be taught effectively (see p. 262 f.).

Passing on to the general public, we find that vast numbers of people (even among those otherwise well-informed) are ignorant of many of the simplest sanitary principles. Were such principles inculcated by the ready means of publicity, not only would the people benefit directly, but the health department would gain a much-needed co-operation in its public measures. The rate of progress of public health work is determined by public permission.

Principles. — Much the same practical psychological principles apply to all publicity work, whether it be that of the commercial advertiser, of the journalist, or of the health officer seeking to instruct his public. The three main objects in the present connection are: to (1) gain

[1] Farrand, "The Development of Educational Efforts in Public and Personal Hygiene in America," *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. iv, part ii, p. 438.

effective attention, (2) to impress and (3) to produce a desire to act or avoid. To attain these objects it is only necessary to observe a few simple rules. These may be studied out in as great detail as necessary, by those who make a specialty of publicity work, in the various manuals on advertising and publicity methods.[1] Health officers in small places may, however, obtain a great deal of excellent publicity material from the sources which make a specialty of supplying it.

1. Gaining Attention. — Effective attention may be gained by the use of originality in captions, cartoons, charts and the like, and arrangements of material which bring out strikingly one particular aspect — or at most a very few aspects — of the matter at a time. In a word, gaining primary interest is largely a matter of emphasis and originality. The object is to avoid the commonplace, while at the same time not distorting the subject. It is, of course, easy enough to attract attention through the specious device of exaggerating one item of the subject to the detriment of others; the proper method is to present all the essential facts — which are usually not many — but at the same time afford a convenient "handle" which the mind cannot help grasping at first sight. The various aspects by which a subject may be approached usually afford several such "handles," of which the most appropriate may be chosen. As regards originality we may add a word of caution on the avoidance of undesirable extremes. In the desire to be novel and striking one should avoid overemphasizing aspects which excite disgust or dread; and on the other hand, humorous devices should not be permitted to distract attention from the serious meaning to be conveyed. Joking and alarmism are equally out of place, detrimental and unnecessary for exciting a normal and effective interest.

[1] Cf. Dearholt, "Educational Publicity in Offense and Defense," *Am. Jour. Pub. Health*, 1912, vol. II, no. 12.

2. Producing an Impression.—When attention has been attracted to the subject clearness and simplicity of language must be relied upon to convey the necessary message. Technical language must be translated into the language of the street. Words short and common must take the place of the longer, more uncommon terms naturally used by the scientist. Note, for example, the superior popular effectiveness of the phrase "Do Not Spit," as compared with "Expectoration is Prohibited." Very few ideas at a time, and those only of the first importance, should be placed before the public. Bulletins, circulars, lectures, should be brief, without too much detail, centered forcefully about a nucleus of thought that everyone will be able to remember without great effort of thought. If the thought can be condensed in a striking epigram or catch-phrase, its power is vastly heightened.[1] Again, the ideas must be presented in a concrete form and with such use of homely analogies and visible effects that people will connect them with, and carry them out in, everyday life. The microscopic organisms of disease, for instance, may be vivid enough to the bacteriologist, but the layman's effort to visualize the other's descriptions has resulted in the grotesque microbe of the comic supplement. The results would be happier if more emphasis were placed on the effects of the germ and the human habits by which it thrives.

3. Providing a Motive. — To produce the desire to act, or in hygiene frequently to avoid or refrain from the forbidden action, it is clear that appeal may be made to the instinct of self-protection. But the motive of altruism, of regard for one's neighbors, should also be invoked. Personal and civic pride, moreover, are considerations. Above all, the citizen should be made to feel that he can play his personal part, however small, in the sanitary campaign. It is he who composes "the public."

[1] The "healthgrams" used by the Chicago Department of Health deserve special mention in this connection.

A word of warning may be added as to the danger of exaggeration involved in aiming to make striking presentments. This has been a frequent fault of sanitarians in the past when it was not always otherwise easy to obtain strict obedience to regulations. Fortunately accuracy is compatible with force in statements, a fact recognized by the Philadelphia Milk Show, which adopted the motto "To enlighten, not to frighten." The health officer should make no statements which he cannot fully substantiate or act upon. Inaccuracy reacts upon its source. The same principle applies to the opposite temptation, perhaps even more common, to gloss over real evils.

Again, more emphasis should be placed upon remedies than upon detailed descriptions of menacing conditions. The human mind is quicker to grasp a danger than to comprehend the means of avoiding it.

Finally, publicity work should be specific and should take up one subject at a time, driving it home in different ways. The endeavor to cover several subjects at once results in confusion and apathy of the popular mind. The effects which have been obtained in the publicity of the tuberculosis campaign exemplify what can be accomplished by a concentrated attack on a matter of paramount importance.

MODES OF PUBLICITY

I. THE PRESS

Perhaps the most effective action of the health officer in the field of publicity is to maintain, through careful statements, *a good press service.* The press is a great, in fact an indispensable, ally of the health authorities. Local newspapers are always ready to publish statements emanating from the health office which have a definite news value.

Value and Use of the Press. — The press far outranks other forms of publicity in that it is the only means of securing compliance with law through wide public knowledge

that the law is being enforced, and in that it is practically the only means of justification of the administration in the eyes of the general public. A single conspicuous account of a prosecution for violation of an important health ordinance may accomplish more toward securing compliance than a month's inspection work. Through the news columns the skilful health officer may talk to his public, explaining new measures, refuting objections and denying false rumors, attacking current hygienic mistakes and superstitions, defending the health budget, allaying groundless alarm, and even, in case of emergency, warning the public of sources of danger — as, for example, has actually happened in instances where it was necessary to issue warnings to "boil the water."

The secret of being able to talk thus with the public lies first, of course, in having the confidence and support of the newspaper editor. Once this point is gained, the editorial columns as well as the news columns will speak for the health administration. Secondly, the health officer must have a clear conception of what constitutes *news*. The "news sense" may be acquired in a sufficient degree by the health officer, yet it is here that he frequently makes mistakes. For example: it is desired to bring out the means of avoiding the common diseases of childhood. If the health officer prepares a list of "Don'ts" on this topic it probably either will prove unacceptable to the newspaper or will appear as "filler" in an emasculated and inconspicuous paragraph, simply because it is not news. But suppose the same remarks are made the substance of an address by the health officer or some prominent physician or are printed as a bulletin and distributed through the schools; then it is quite possible that they will appear *in toto* and if striking in expression receive editorial comment. On the same principle events relating to the health department which the newspapers see fit to report should frequently carry with them some illuminative comment by the health officer or

other influential person. It is the repeated impressions on the public mind, produced by such bits, that spell popular education.

In the consideration of news value, it is important to know what the editor will consider the best news, for it is this that he will "feature." It is the special feature of a "story" which will be headlined, and many persons will scarcely read beyond the headline. Sometimes a comparatively unimportant, or even a trivial, matter will be thus rendered conspicuous. It is a good rule always to give the press a "feature," but one which will serve the cause of good administration.

Press Bulletins. — In order to guard against error, important statements from the health office should be given out in writing. It is a simple matter, if there is more than one local paper, to make typewriter carbon copies for each, marking them with a date and hour (for example, "For release at 12 noon, April 25") for the guidance of the editors, and giving them out at least three hours, and if possible a day or two, before the earliest paper goes to press. The more condensed a statement is, and the earlier it is received by the newspaper, the more likelihood there is that it will appear in full. Thus, whenever possible, instead of sending in matter at the last minute the preferable procedure is to mark it to be held up until the following day's edition. Such written statements should bear a brief title (not headlines) to indicate the subject.

Press Interviews. — The newspaper reporter usually "covers" the health office as part of a regular "beat." There is scarcely any individual with whom it is more important to keep on cordial and even confidential terms than the reporter. Such relations are fraught with benefit to both sides. It is an excellent practice to meet the representatives of the press every morning for a few minutes at a stated hour for interview. Everyday matters may furnish good news items, while on the other hand hints or

rumors dropped by the reporter may turn out to be of importance to the health officer. If it is desired to impress upon the public some extensive subject, information may be given out piecemeal and thus spread out for several days in a series of news items; in this way, too, a desirable running interest in health department matters is kept up in the public mind. At any rate it is always desirable to give out something of interest, however slight. It may sometimes be necessary to share certain confidences, and at such times the discretion of a worthy reporter may be relied upon. In giving out official news as to communicable disease and the like, reference to names should be avoided, as is even required by law in some states. Such cases may be referred to in general numbers. Regarding official records in general the health officer should inform himself as to legal provisions and the desirability of making public the facts contained therein.

Accuracy. — It is not infrequently charged that the newspaper press is inaccurate, for which reason some persons go to the illogical length of refusing it all confidence.[1] In cases of inaccurate reporting or writing certain palliating factors should be taken into account: such as the unfamiliarity of the journalist with special fields of knowledge and endeavor, the necessity of haste, the difficulties encountered in collecting information in fragments or from conflicting sources, etc., not as excusing all inaccuracies, but merely as indicating adverse conditions which should influence the public official to modify his judgment of the newspaper man and to endeavor to decrease the latter's difficulties in these respects. Where a press account is misleading, either through misstatement of fact, through wrong implication, or through misplaced emphasis (e.g.,

[1] It is interesting to note, however, that in some fifty newspaper clippings relating to board of health work, collected by a press clipping bureau from all parts of the United States, the writer has been unable to find any instances of *apparent* material inaccuracy.

in the captions), the fact may in some instances be attributed to the health official from whom the information originated. The latter, familiar with his specialty, may easily fail to convey an accurate idea to the interviewer, who is a layman so far as sanitary science is concerned. A health officer, for example, makes a hasty statement to the effect that the colon bacillus has been found in the city water several times in 1 c.c., the finding indicating the necessity for cleaning up a certain contamination. The reporter, having nothing further to go upon, returns to his paper with the statement that the *typhoid* germ (not an unnatural inference for the layman) has been found in the city water and that the health officer considers the situation serious. A little time taken to explain the nature of B. coli and the significance of quantitative findings, with a word of caution to spare alarm, would have radically changed the character of the report. But familiarity with the subject caused the sanitarian to neglect all this. While such instances are perhaps uncommon, they illustrate the necessity for making all such statements clear and explicit.

Unusual Conditions. — The question may arise as to how far publicity may be authorized and just what matters should be given out when unusual conditions prevail, e.g., in case of an epidemic. Unless some certain benefit is otherwise to be gained, it is usually and rightly the policy of health departments to preserve silence until some degree of publicity becomes necessary. If only a small supernormal number of cases of communicable disease exist no notice will probably be taken, but if there is a well-defined epidemic, sooner or later the press will appear with rumors for confirmation or denial or facts for explanation; the health officer must then speak.

To make "no comment" under such circumstances is to leave the reporter with only the rumors or evidence which he has collected elsewhere to go upon, with the inference that they contain more or less truth, and the publi-

cation of these may frequently result in producing an erroneous or even decidedly harmful public impression. To avoid this serious danger, as well as to avoid any suspicion of a policy of concealment, it is wise to make some definite statement, however brief or non-committal. This it is always possible to do with good faith and a regard for truth, and if credible information has come to the notice of the press it has a virtual right to such a statement. Moreover, it is in many cases wise to be absolutely frank with the newspaper men in telling them all the essential facts in confidence, at the same time pointing out those aspects, the publication of which would be deleterious and indicating just what statement may truthfully be made with the approval of the health officer. Such confidence will always be respected by the reputable newspaper man and will contribute greatly to easing the situation and establishing mutual good relations. The safest plan is to give out a careful written statement accompanied by confidential discussion.

Suppose, for example, that there is an outbreak of typhoid fever, on which no data, except the increased number of reported cases, have as yet been ascertained. The first bulletin may well contain a statement of the number of cases, with the comment that this should lead to no apprehension on the part of the citizens at large; it may be added that the matter is under investigation, certain facts are being ascertained, etc. By the next day the distribution of cases may perhaps have been sufficiently determined to show that only a restricted locality is seen to be affected. A statement may then be given out that one possible source — the general city water supply — has been exonerated. This furnishes reassurance and a news story. As further progress is made, the facts may be announced in a careful manner until it can be stated that the source of the epidemic has been run down and is under control. In all of this the mention of personal names and details should be avoided;

cases should be mentioned by numbers and general location, and special care should be taken to spare so far as possible mention of persons whose reputations or business might be unjustly injured. Such a policy of frank but cautious publicity will both allay public anxiety and increase confidence in, and respect for, the health administration.

II. PRINTED MATTER

Important as is the press as a means of general publicity, it has the drawback that the health officer is unable to govern directly the impression to be made on the public. This difficulty is absent in the "literature" of the health department — the various bulletins, pamphlets, circulars, leaflets and posters which it may issue from time to time, usually for special purposes. In these the health officer has a free hand, subject to the general publicity principles already set forth, and through them can reach directly the more intelligent portion of the community.

Bulletins. — It is desirable, circumstances permitting, that the larger municipal, as well as the state, health departments publish regular monthly bulletins containing popular educational matter and setting forth concisely the state of the public health.[1] In such bulletins emphasis should be laid upon matters within the comprehension of the average citizen and in which his coöperation is feasible, rather than upon tables of statistics. A mistake has been made in some instances of printing detailed tables of vital statistics and other matters of permanent record but not of popular interest, in space which might much more profitably

[1] Health bulletins are now issued regularly by a number of state and municipal health departments. Among the former we may mention especially California, Kansas, Massachusetts, New York, North Carolina and Virginia; among the latter, Chicago, New York and (as an example of a small city) Asheville, N. C. See Greeley, "What the States and Cities of the United States are doing in Public Health Education Work," *Am. Jour. Pub. Health*, 1914, vol. IV, no. 9, p. 733.

have been utilized in printing simple and interesting instructive matter. An apt cartoon is always in order.

If a periodic bulletin is published, advance copies should be sent to the local press several days before issuance of the regular edition. Some boards of health, e.g., those of Montclair, N. J., and Palo Alto, Cal., arrange with a local newspaper to print each week in this paper a "board of health corner," the material being furnished by the health officer. In this "corner" or column, which takes the place of a circular bulletin, a very brief résumé of the week's work of the health department is given, including numbers of cases of communicable diseases and deaths from principal causes, some public health subject is treated in a popular manner in a short essay, and questions on public health topics are answered by the health officer. This is a useful means, not only of disseminating information, but also of putting to rest rumors as to the communicable disease situation, etc. It must, however, be remarked that the maintenance of any such regular service places a considerable demand upon the time and thought of the health officer and had better not be attempted unless there is certainty that it can be constantly kept up.

Reprints from Annual Report. — Another thing that may be done, more easily and with good effect, is to reprint those portions of the annual health report which are of especial interest to the public: for example, the sections giving the ratings of milk dealers, dealing with special problems in which the coöperation of the public is desired, and the like. This has been done by the health department of Montclair, N. J., for several years, copies being distributed to every dwelling in the city, and the coöperation gained, especially in eliminating the undesirable milk dealer, has well repaid the practice. Inasmuch as much of a thorough annual report is by no means of popular interest and would be wasted upon any but the most intelligent citizens, the value of the popular reprint is clear. In that

town, also, a pamphlet entitled "Rules, Regulations and General Information Concerning Communicable Diseases" has been printed and circulated among physicians, medical inspectors, teachers, heads of families and nurses. It may be added that in this instance there is a large proportion of intelligent citizens who profit by such literature and encourage the issuance of it.

For certain specific purposes the issuance of *special circulars, posters, etc.*, may be desirable. Exhibitions and campaigns for pure milk, against the spitting nuisance, for a general "clean-up," and the like, demand plenty of auxiliary printed matter, both to advertise and to explain.[1]

For some purposes posters are effective and may be displayed in store windows, on public bulletin boards, etc. The Chicago Department of Health, for example, has been successful with large posters (4 by 6 feet). Even the billboards may on occasion be utilized, as has been done in the tuberculosis campaign.

Distribution. — The question of distribution will naturally arise. Bulletins and reports are frequently sent out on a mailing list comprising (1) citizens and local officials who will benefit by them and (2) a selected number of "exchanges," i.e., interested boards of health, organizations and individuals in other municipalities. A local list may readily be started by means of the ordinary or the telephone directory. For certain classes of matter a mail distribution may be all that is required. The labor of stamping may be avoided, if the number of identical pieces of mail matter amounts to a thousand or more, by taking them to the post-office in bulk. If, however, the distribution is to be general

[1] Printed matter for publicity on stock subjects may be obtained from sources mentioned in note, p. 563; also from Cameron, Amberg, and Co., 15 West Lake St., Chicago, and Kirchner, Mechel and Co., 117 North 5th Ave., Chicago.

and the cost of postage (let alone addressing, folding, inserting, stamping and other clerical labor) is taken into account, house-to-house distribution is cheaper.[1]

For certain classes of circulars, etc., the health officers may be able to obtain distribution by volunteer workers from local organizations.

Circulars, etc., may often be most advantageously distributed through the schools; by this means there is obtained a wide, though not universal, distribution at practically no expense. In obtaining the permission of the schools a statement may be secured showing the number of pupils in each room and the circulars may then be delivered in properly counted and marked bundles. The success or failure of the method will depend upon whether or not the coöperation of the school authorities is obtained to such an extent that the necessity of taking the circulars home is impressed upon the children. After some experience the writer believes that under the best conditions the great majority of the circulars will reach the homes. It is well to print in heavy type at the top of the sheet, or upon an envelope enclosing the matter, the legend "To be Taken Home," or something similarly impressive.

The publicity technique of printed matter will depend partly upon general principles, partly upon the class of persons to be reached. For persons who will read and reason, a plain piece of text at some length may be acceptable, but this class is usually small and the *brief* statement

[1] In Montclair, N. J. (population 25,000), approximately 1000 annual reports and 3000 reprints from annual reports are distributed by the house-to-house method. The cost is $22 for the 4000 copies ($5.50 per 1000), at $2 per man per day. This includes ringing each door-bell and handing the report in. It is intended that every family shall have either a report or a reprint. "Our reports cost 3 cents each to mail. If they cost only 1 cent distribution by messenger is cheaper, even in a scattered community like Montclair." (Information from C. H. Wells, Health Officer, Montclair, N. J.)

or striking cartoon is much more effective. The best circular or poster (unless purely of the cartoon type, which is in some respects the most useful of all) is a combination of text and pictorial matter.

III. EXHIBITIONS[1]

Of recent years civic exhibitions have been growing in favor and, among them not only general public health exhibitions but also those devoted to special subjects, such as tuberculosis or milk supply. If given plenty of publicity, especially through press notices and the activities of strong coöperating committees of citizens, and if made conspicuous by striking and original features of local application, exhibitions draw large crowds and start waves of popular interest as scarcely anything else can. Moreover, an impetus is given for a steady campaign, which may — as it should — be kept up long after the exhibition is over. Aside from the direct educational effect, the improved public opinion makes adequate health funds easier to obtain and facilitates administration. There is no better way for an energetic health officer to start a campaign for general support, or for some special object, such as tuberculosis or infant hygiene work or control of milk supply, than this. There are few towns in the United States which would not be benefited by a good health exhibition.

Such an exhibition may perhaps take place in connection with a "Health Week" as has been conducted in Louisville, Ky., a "Baby Week," as in New York, and the like.

Exhibitions have a particular advantage in that they impress various kinds of persons: the literate and the illiterate, the intelligent and unintelligent; even the unwilling

[1] By an "exhibition" is meant a more or less extensive display having a number of related special parts. The term "exhibit" is reserved for smaller displays, especially those limited to one subject or point. Thus an "exhibition" would be composed of a number of individual "exhibits."

are first interested and then persuaded. Almost all the various modes of publicity may be pressed into action: pictorial posters, photographs and diagrams to attract attention; printed placards, literature and attendants to explain; all kinds of models and mechanical devices; lectures, stereopticon views and motion pictures. All of these, combined with the press notices which are sure to accompany a good exhibit, constitute a veritable battery of publicity.

PLANNING AND MANAGING AN EXHIBITION

It frequently happens that inexperienced persons are called upon to handle exhibitions and that much time is wasted in preparation and much of the final effect lost through neglect of simple though not always apparent considerations. In fact, shortcoming in a single important matter, such as organization, the choice of a location, or the means of publicity may impair or prevent successes.

Secure Coöperation. — Let us suppose that the health officer has decided that the publicity power of an exhibition is needed in some one or in all departments of public health work in his community. How is he to go about starting a campaign for that object, and how, in outline, is the campaign to be carried out? In the first place he may be able to persuade his board that an exhibition is needed and to obtain from the city treasury the necessary funds. If, however, there is question of this, it may be well to do first *what should be done in any case, — secure the interest of as many as possible prominent and public-spirited citizens and the local civic societies.* The coöperation of the local anti-tuberculosis society, visiting nursing association, and other related organizations should also be secured. The indispensable value of coöperating citizen committees in securing prestige and publicity will be mentioned again later.

Form General Committee. — Assumed that the possibility of a successful exhibition has been assured, the first step will be the formation of a general committee of influential persons. This committee should be fairly large, and even if some of the members furnish no more than their sanction, it forms a responsible body of well-known citizens who will lend importance and dignity to the project and plans and will obtain the coöperation of persons who are desirable for the associated committees which will be described below. Upon the latter devolves responsibility for carrying out the various assigned divisions of activity.

The general committee will elect its chairman, who should be a prominent citizen who will act as presiding officer but not director of the work.

FUNDS. — The first and most important question to arise will then be that of funds. The whole scope and quality of the exhibition will necessarily depend upon the amount of money which can be raised and expended. Some appropriation can perhaps be obtained from the board of health or municipal council, but this, especially on short notice, would not be likely to be sufficient for an adequate exhibition. Hence, subscriptions from private persons and organizations must be obtained. It may be that guarantees can be obtained without delay from such sources sufficient to insure that an exhibition on the scale desired can be held; or a committee on ways and means may be appointed to obtain subscriptions.

EXECUTIVE COMMITTEE AND DIRECTOR. — As soon as funds are assured an executive committee should be appointed (see below as to composition). This committee holds frequent meetings, reporting its plans and activities to the general committee for approval from time to time. It is here that the driving force of the work resides, and particularly in its chairman, who acts virtually as *executive director*. This part may, perhaps, though not necessarily, be taken by the health officer. At any rate the person chosen should possess executive ability, tact, and good taste, and should be thoroughly acquainted with the principles of the modern public health movement. It would be a vast advantage in those places which can afford it and where the local leaders can be led to appreciate the advantage, to employ a *trained professional director*. Not only the training of such an expert director, but also his outside point of view is an advantage. Even where such a director cannot be employed, outside expert advice is of great value.[1]

COÖPERATING COMMITTEES. — These should be formed at the same time as the executive. It is best to form each of these under the chairmanship of a member of the executive committee. The latter should

[1] The Russell Sage Foundation of New York has recently organized a Department of Surveys and Exhibits having as one of its chief aims to assist communities in planning and executing health exhibitions, an aim which had earlier been adopted by the Bureau of Municipal Research of New York. Both of these have a national scope and information and services are furnished by them to local organizations. The former publishes a pamphlet on "Social Welfare Exhibitions" (price 25 cents). Addresses: Sage Foundation, 130 East 22nd Street, New York City; Bureau of Municipal Research, 261 Broadway, New York City. Valuable hints may be obtained from the reports of the Phila. Baby Saving and Milk Shows (already referred to, pp. 344, 395).

be no larger than is necessary for this purpose, but members may be added to it from time to time if required. It would perhaps be wise to have the chairmen of the coöperating committees report and confer in informal meetings of the executive committee and report only occasionally in a formal manner to the general committee. In this way the latter would be kept in touch with the actual activities going on, and could give its general approval; though after the start its position would be largely formal.

The most important of the coöperating committees would be somewhat as follows: Finance, Publicity, Hall, Exhibits, and Program. The main duties of these committees will be indicated in order below. It may, of course, be desirable to arrange the functions somewhat differently or to subdivide some of the committees above suggested. It would be well to get as many persons working on the various committees as can be effectively managed, as not only is more help thus obtained but a wider circle of influence in attracting publicity is the result. The whole organization should be as elastic and adaptable and free from unnecessary formality as possible, but for each committee and each person the duties would be very clearly defined.

One of the first important points to be determined by the general or the executive committee is the *time* when the exhibition is to be held. Assuming that satisfactory arrangements for location can be made, the dates should be such that full public attention can be secured, free from the distraction of other public events and activities. It should, moreover, be some weeks in advance, so as to allow plenty of time for material to be collected, worked into form, and set up. No one who has not had to do with the preparation of even a small exhibition realizes the time and labor involved in the production of first-class exhibition material, and no other kind should be invited. Exhibits are likely to be late and accidents may occur, but eleventh hour hurry should be avoided. The duration of an exhibit, and the daily hours, may constitute a question. Favorable hours are 12 to 10 P.M. A period of less than a week would scarcely be worth while for any exhibition; a longer time is better. The reason for this is that during the first few days, the public is sceptical, and the scepticism can only be broken down by a steadily increasing attendance and the interest aroused by the accounts of the press and of the early spectators. The interest will usually grow up to about the end of the first week and then remain for some days at a maximum.

The duties of the finance committee (which may be the original ways and means committee continued) require no special comment.

PUBLICITY. — The publicity committee has functions of first importance. At every stage it conducts a full press service, in which the

coöperation of the newspapers may be counted upon. It also makes effective use of the other modes of publicity, such as public bulletins and posters, handbills, "sandwich men," and any other legitimate and novel devices. The coöperation of the schools may be enlisted and circulars sent out by distribution to the pupils with the instruction to take home. Announcements in churches, clubs, labor organizations, lodges, etc., may be requested. The exact time and hours of the exhibition should be emphasized and it should be made evident that *everybody* is expected and that a large attendance is expected. An important point at the time of the exhibition is to have the approaches and entrance well placarded. The publicity committee will have plenty of opportunity for the exercise of activity and imagination.

Location and Hall. — The committee on hall will find a place for the exhibition to be held and make all arrangements (e.g., cleaning, heating, lighting) in connection therewith. This may be determined somewhat by space requirements (see below). It is essential, however, to secure a place where people are accustomed to go and where they will find it easy to go. An assembly hall, armory or part of a school may serve well, provided it has a prominent location near the business center of the town. It should be on the ground floor, or at least not higher than one flight up, and the entrance should be large and conspicuous. A sufficiently large empty store is very favorable. It should be possible to find a place of one of these kinds where no charges, or only very moderate charges for light and janitor service, need be paid.

A common mistake is to secure too little space, resulting in a cramped exhibition "viewed" by a swarm of hot and irritated spectators worming their way through congested aisles and corners. Even leaving out of account esthetic considerations, the demands of ventilation make full space a prime desideratum. There is little danger of getting too much; the amount of wall area which an exhibition may be extended to cover with good effect is surprising. Proper grouping will prevent a straggling appearance, but nothing can obviate the sense of confusion produced by crowding even well composed exhibits. Better a fully spaced though comparatively limited exhibition than a more pretentious one injured by serious cramping.

Another consideration is that there shall be an *auditorium*, or a space where a platform and hired chairs can be placed, for the addresses to be held in connection with the exhibition. Special arrangements are also usually necessary for erecting and operating a stereopticon or motion picture machine. Gas or electricity must be looked after and legal regulations, if any, ascertained.

Exhibits. — To the exhibit committee belongs responsibility for the composition and arrangement of the exhibition as a whole. It must

naturally work in close touch with director and health officer. It has to make the necessary arrangements for obtaining exhibits from various sources, when necessary, advising the planners of the individual exhibit. The latter in their turn should see that the material to be presented is put in proper form through the services of draughtsmen, photographers, and sign-painters; amateur work in these lines, unless expert, is ineffective.

There should be kept constantly prominent by the director and exhibit committee a well-proportioned *plan* for the exhibition as a whole, into which the various groups shall fit harmoniously and in proper degrees of emphasis.

In order to insure orderly and timely installation certain definite rules should be adopted, e.g.:

(1) That each organization or department contributing be assigned a definite amount of space proportioned to the importance of that organization.

(2) That a definite date be set when all exhibits are to be in place; say two days before the public opening.

Through tactful conference with those furnishing material it should be so far as possible edited both as to content and as to form. The great difficulty with all exhibitions is to know what to leave out. The material at the disposal of the exhibitor is so great and all seems to him to be so important that there is an almost irresistible tendency on the part of the inexperienced to include too much. Too many facts are worse than too few, for the latter situation is at least in accord with the psychological principle of publicity that only a very few facts can be presented at a time. Spectators find exhibits tiring and confusing on account of the excessive amount of material displayed and find it impossible to make the round properly in the limited time at their disposal. It may be taken as an axiom, therefore, that *only the few essential points should be presented and those as vividly and simply as possible.* In the long run quality will count strongly, while quantity is only a hindrance. Detailed information, it is to be remembered, may be always *available*, in the form of circulars, reports, etc. But to present everything that is merely presentable, through a mistaken sense of proportion, is a fatal error, and a vast waste of time and labor.

Exhibits are much enhanced in value through the presence of *demonstrators or explainers* to draw attention to them, explain, answer questions and give out literature. Arrangements should be made for the services of such persons at the most important exhibits, at least at the hours of greatest attendance. For this purpose a schedule for the volunteer services of members of societies and other interested persons may be arranged.

PROGRAM. — The program committee plans and makes all arrangements for the addresses and lectures to be given during the course of the exhibition. It is assumed that the hall committee has arranged a suitable auditorium or space of sufficient size where an audience may be accommodated. In composing the program both its *attractiveness* and its *educative value* should be considered. It is good policy to obtain addresses by the Mayor and prominent citizens, or, better, have one such person preside at each session, the Mayor, if possible, on the opening night. The president of the local board of health, the health officer, prominent physicians and others may be included. If at all possible addresses by public health experts from outside the community should be secured, these carrying special weight. Addresses should be brief, — say not over five or ten minutes except for the main lecture of the evening; even the latter, however, should be limited if possible to half an hour. We speak here of the actual time consumed, which always, as explained below, exceeds that literally allowed. In general, in view of the necessity of allowing time for the exhibit to be viewed, the audience should not be expected to remain in the seats over an hour. Agreement should be made with each speaker as to the time he is to occupy, so as to do justice to the others on the program. Speakers are very prone to run over time, and to correct this tendency, instead of endeavoring to enforce a strict rule, it is better to assign each speaker a very limited time on the unexpressed assumption that he is almost certain to excess it more or less. Thus "ten-minute" speeches almost always last fifteen or twenty minutes, "fifteen-minute" ones nearly half an hour, and so on, and a session which figures up on the program to three-quarters of an hour will actually run to something over an hour, even if there is no discussion.

A good arrangement is to *devote each session to a special subject* or limited group of subjects, with a main address by a prominent speaker preceded by brief addresses by several others. The latter may be five- or ten-minute speeches. A lecture illustrated with *stereopticon* or a *motion picture* exhibition forms an especially good main "feature" for a session. Subjects may be subdivided or combined to fit the number of sessions or addresses which can be devoted to them. Distinction should be made between the afternoon and evening sessions; comparatively few adults will be able to attend the former and hence they may perhaps be used for prearranged visits of groups of school children, for whom no formal or extensive program, possibly only a brief illustrated lecture, is required. If various nationalities are represented in the community another arrangement of the program is possible, allowing a special night for each of the important ones. Other population groups may also be arranged for, especially in an industrial community. Further remarks on lectures will be made in a later section.

Special Exhibition Material. — Some of the best exhibition work can be done by means of rented or borrowed material from special sources. When such material is used a great deal of local planning, labor and expense can be saved.[1] Very useful small exhibits (see next section) can also be thus obtained. Local health officers can do a great deal to further the health exhibition movement by inducing their state departments of health to provide traveling exhibits, and by approaching the extension departments of their state universities with a similar object. Some of the latter, particularly in the upper Mississippi Valley, are already taking up social welfare and health exhibition work. Groups of towns or cities could also work up a coöperative arrangement, each one developing an exhibit dealing with some special subject, these to be interchanged among them. All arrangements by which the same material can be utilized repeatedly by various communities make it possible to produce the highest grade of exhibits at the minimum of cost. Economy may also be practiced by getting models and devices and cartoons prepared by local manual training or art schools and by other organizations or persons who are interested. A good idea of the kind of material used in health exhibitions may be gained by a visit to those accessible in New York, Chicago and other large cities.[2] Suggestions may also be gathered from the reports of the Philadelphia Milk Show and Baby Saving Show.[3]

[1] Such material can be obtained from: the Department of Health, Chicago; Am. Assn. for Prevention of Infant Mortality, 1211 Cathedral St., Baltimore; Dept. of Child Helping, Sage Foundation, 130 East 22nd St., New York City; Nat. Child Welfare Exhibition Committee, 200 Fifth Ave., New York City; Nat. Assn. for Study and Prevention of Tuberculosis, 105 East 22nd St., New York City; and other national health organizations; also from the Educational Exhibition Co., 26 Customhouse St., Providence, R. I.

[2] List of these will be supplied on application to Dept. Surveys and Exhibits, Sage Foundation, 130 East 22nd St., New York City.

[3] See pp. 344 and 395.

IV. SMALL EXHIBITS

In many cases, especially in small towns, it may not be possible to work up an exhibition on the scale suggested above. In such instances the use of single exhibits is highly to be recommended, and under any circumstances it is desirable that the health department have constantly one or more such exhibits on view. It is possible for practically every health department to make up, or purchase or hire from one of the sources given above, one or more simple but effective exhibits which can be set up in vacant stores, store windows, schools and other places in the public view. In the larger towns such exhibits may be moved occasionally to a new place so as to attract the notice of a different portion of the public.

Again, it not infrequently happens that a fair or local exposition affords an opportunity for the health department to take part. Thus, if the chamber of commerce or business men's association holds a local fair or industries exposition it will often be possible for the health officer to obtain an exhibition booth rent-free. Such opportunities occur from time to time in a great many towns.

Small exhibits may consist in models, charts or demonstration material. As to subjects, instead of trying to cover the subject of public health in a general way, the aim should be to present one seasonable idea at a time, and even to use only a single effective model, chart, cartoon or device.[1]

V. LECTURES

The progressive health officer will frequently be called upon to deliver lectures, addresses and talks before more or less influential civic and philanthropic bodies and before popular audiences. There is only one important caution about accepting such invitations: be sure that the audience

[1] Such may be purchased or hired if desired. See preceding section and note, p. 563.

will be worth the effort and publicity entailed. It is, therefore, discreet to choose only the best. Time and energy may be consumed addressing very minor organizations, which could better be concentrated on a few occasions to deliver definite "messages" which will have wide publicity and influence. Better, in short, half a dozen important speeches a year than several dozen minor ones.

While the health officer is the natural leader of all discussion on public health topics, addresses by the president of the board of health, the mayor and other prominent and well-informed physicians or laymen are frequently useful.

METHODS. — A public speech cannot be too carefully prepared, and the speaker should be ready to have searching questions put to him. A good short address without the use of notes is usually, perhaps, most impressive. On the other hand, if an effective speech cannot be so delivered, it is better to write out and speak (not merely read) from the manuscript. Clear and simple charts, diagrams, photographs and models may serve in lieu of notes, and the same purpose is served by the lantern views of an illustrated lecture. These accessories are also frequently desirable to make one's meaning clear and to interest and impress the audience.

The principle already mentioned—that only a *few points* should be taken up and these treated in a vivid manner and illustrated by striking, even humorous, examples — applies to public addresses, as well as do the other basic principles of publicity. Rarely should an address be over a half-hour in length (illustrated lectures excepted), and a quarter-hour concentrated upon one or two important topics is sometimes even better, especially when there are other speakers on the program. Even at that the speaker has an opportunity to deliver about 2000 words — $1\frac{2}{3}$ newspaper columns or three times as many words as the editorials of metropolitan dailies devote to the principal topics (without taking into account the fact that

one reads about twice as fast as the public speaker speaks). There is a tendency on the part of all speakers to run over time, a ten-minute speech becoming fifteen or twenty minutes, a fifteen-minute speech half-an-hour, etc. Hence, the caution is in order *never to run over the allotted time.* For inexperienced speakers (and some experienced ones as well) the hint to speak somewhat slowly and distinctly may often be of value. It is advisable to bring out clearly in the opening words the subject of the discourse, and in the closing words to draw together the points to be emphasized.

In passing, a word may be said as to statistical and other data. It is necessary for the health officer to have such facts near the tongue's end for ready reference at any time. While the quoting of "round figures" has its dangers, neither is it necessary to memorize columns of figures which weary both speaker and hearer. What the public desires and understands is not detailed statistical analysis but a few definite, accurate figures which can be simply stated without "about's" and "approximately's."

As to publicity, *press notices* are especially important, not only before but also after the event. In order to guard against misquotation and to insure a good press account, the speaker should if possible prepare a draft, at least in outline, of his address and furnish to the newspapers several days beforehand "advance" copies marked with a memorandum of the date, hour and place of delivery. The fact that an address is delivered to only a comparatively small number of people is thus compensated for by the wide circulation given by the press to even a portion of the matter delivered.

The use of *lantern slides, charts, etc.*, in lectures is an especially important consideration. The value of such material depends upon its choice and the method of use. Such illustrations should not only be strictly appropriate to the particular use that is made of them, but should also be fully explained. Too rapid exhibition may interest

the audience without allowing sufficient time for explanation of each point by the lecturer and its comprehension by the audience. In short, the lecturer should not make his remarks a mere passing commentary on the illustrations but should rather use them as *texts* for his discussion. Thus comparatively few slides or charts, if to the point, need be used. Their *order* should be carefully planned, so that a logical sequence may be obtained.

Good lantern slides, separately or in sets, may now be obtained at a moderate cost, or the lecturer may have slides made from his own material by the firms specializing in their manufacture.[1] Lantern slides should be technically perfect, and good plain slides are better than inferior colored ones.

VI. MOTION PICTURES

The influence of motion pictures is obviously wide, and their impressiveness from a psychological point of view great. There is now a wide range of educational films upon the screens and among them a number which deal with public health subjects, e.g., tuberculosis, unsanitary working conditions, typhoid fever, etc. The managers of moving picture theatres frequently have lists of such films[2] and are usually glad to obtain and show them as a regular part of their performance if the health department or other organization will give them some publicity. With the more extensive development of small-size motion picture apparatus for schools, clubs, lodges and other similar audiences, this form of publicity will become increasingly available.

Motion pictures have, however, certain *limitations*. It must not be supposed that they can satisfactorily displace any other method. As an attraction their value is high,

[1] For information as to the various sources of such material apply to the Dept. of Surveys and Exhibits, Sage Foundation, 130 East 22nd St., New York City.

[2] Or apply to Sage Foundation (*supra*).

but a disadvantage lies in the fact that very little explanatory matter can go with them on the screen and practically none at all by word of mouth. They are based on action, and a great many important facts can be conveyed by action in only a roundabout way or not at all. It seems to the author that the educational — as distinguished from the attractional — value of this form of entertainment tends to be overrated. It must also be remembered that it is difficult, expensive or impossible to arrange for moving pictures in many places where other effective forms of publicity are more readily available.

PUBLICITY AND ADMINISTRATION

While wise and persistent publicity will accomplish much, we cannot close the subject without a caution as to its limitations. It must be remembered that there are great numbers of people who are not affected — or are affected only remotely — by publicity, and that the sanitary education of the masses is a limited and gradual process. Publicity can, in fine, only facilitate or supplement administration, not supply a substitute for it.

On the other hand, apart from the question of permanent educational effects, publicity has a direct and immediate value in stimulating public opinion to a sense of community health needs, thus conducing to adequate funds and moral support.

APPENDIX A

DISINFECTION AND DISINFECTANTS[1]

TERMS

Disinfection is the process of destroying pathogenic (disease-producing) microörganisms. It does not necessarily mean the destruction of *all* microörganisms — which is *sterilization.* Absolute sterilization is not usually necessary in public health practice; efficient disinfection destroys the harmful organisms, while those remaining are for the most part hardy but harmless forms, the destruction of which is impracticable and unnecessary. Only in the case of a few infections — e.g., anthrax and tetanus — which have resistant spores is absolute sterilization necessary. It is, however, sometimes desirable to require practically complete sterilization (e.g., of milk utensils) in order to insure that there is thorough disinfection.

Agents, physical or chemical, which disinfect are called *disinfectants.* Those which destroy germs, without reference to their character, are called *germicides*, a term frequently used interchangeably with the other.

There is another class of substances known as *antiseptics.* These simply retard or prevent the growth and activity of microörganisms without necessarily destroying them. In other words they hinder or prevent "sepsis" (bacterial fermentation). Thus a minute quantity of formalin (say 1 to 50,000) will prevent the development of bacteria, but it requires a much greater quantity (3 to 5 per cent) actually to kill the bacteria within a reasonably short time. In the former instance the formalin is used as an antiseptic, in the latter as a germicide (or, if infectious disease organisms are present, as a disinfectant).

Asepsis is a state of freedom from living microörganisms. Thus a process of sterilization results in a condition of asepsis, which may be maintained indefinitely by excluding all germs. In this sense we speak of aseptic methods in surgery.

A class of substances quite distinct from the above are the *deodorants*, which destroy or neutralize odors due to putrefaction, etc. Many of the disinfectants are, as it happens, also deodorants, but the popular impression that deodorants are always disinfectants is incorrect, for only

[1] For general remarks as to the value and modes of employment of disinfection see Part II, Chapter I, pp. 123 f., 131 ff.

in certain instances is this the case. Charcoal, for example, absorbs odors, but exerts no disinfectant or germicidal power. On the other hand bichloride of mercury acts as a germicide without removing odors. Formalin, however, is an example of a substance which possesses both properties. The term deodorant does not, it may be noted in passing, properly apply to those strong-smelling substances which merely mask one odor with another.

DISINFECTANTS

For removing or destroying the danger of infectious material the best agents are those which are simplest and nearest to hand: cleanliness and heat in its various forms. Too much stress has in the past been placed upon chemical disinfectants, which are not always readily available, which are frequently ineffectively applied, and which are often powerful poisons. To prepare disinfectant solutions requires a degree of intelligence which cannot always be expected, but any housewife can apply soap and water and either burn up infected objects and materials or simply boil them on the stove. Except for the disinfection of excreta and the care of the nurse's hands, there is little need for chemical disinfectants, which are only too often used to ward off the dangers of carelessness and uncleanliness.

The following descriptions are by no means exhaustive; rather is stress laid on the simpler methods which may be readily applied in any household.

The value of *cleanliness* — particularly of personal cleanliness — as a prophylactic measure cannot be too strongly insisted upon. While only a part of the dirt ordinarily met with may be the vehicle of infection, nevertheless decency and prudence bid that all filth be treated with the same abhorrence. And this has reference particularly to the transference of even small amounts of secretions and discharges from person to person. If cleanliness in this sense were maintained by all persons certain communicable diseases would be practically wiped out. If such cleanliness were maintained in the sick-room the need for chemical disinfection would be much lessened. But owing to popular ignorance as to modes of infection, possible carelessness, and the practical obstacles to an ideal degree of cleanliness, the additional safeguard of disinfectants is relied upon to prevent infection from known cases of communicable disease.

PHYSICAL AGENTS

In nature there are various agents, e.g., sunlight, desiccation, extreme heat and cold, etc., which tend to diminish greatly the pathogenic organisms at large. It is the part of sanitary science to utilize so far as possible these natural means.

Sunlight has a certain germicidal effect. Practically, however, it can only be utilized as supplementary to the usual methods. Rooms and articles which have been disinfected should, whenever possible, be exposed to fresh air and sunlight.

Heat is a highly efficient and practical disinfectant agent. It may be applied either dry or moist. Assuming the temperature is the same in both cases moist heat is more effective.

The simplest application of dry heat is by means of *burning*, and many articles such as cloths, rags, papers, sputum cups and others of little or no value are best burned up.

The simplest application of moist heat is by *boiling*. This method is available in practically all households and highly to be recommended. Bed linen, personal linen, eating utensils and other washable articles are thus most readily and surely disinfected. Moist heat of 60° C. (140° F.) for 20 minutes will destroy the microörganisms of cholera, typhoid fever, dysentery, diphtheria, plague, tuberculosis, pneumonia, erysipelas and practically all non-spore-bearing bacteria[1] (Rosenau). Boiling kills them at once, but should be prolonged for some minutes in order to insure penetration.

Dry heat is effective but is not as satisfactory as moist heat for the reasons that it lacks power of penetration and is injurious to fabrics. A temperature of 150° C. for one hour will destroy all forms of life, even the most resistant spores. "The ordinary household cooking oven is as good as any specially contrived apparatus for the disinfection of small objects by dry heat. In the absence of a thermometer it is usual to heat the oven to a point necessary to brown cotton and expose the objects no less than one hour" (Rosenau).

[1] The bacilli of anthrax and tetanus form hardy spores which resist the ordinary methods of disinfection, though as a rule (not invariably) they are killed in streaming steam or boiling water in 60 minutes. "Tetanus [and, since their resisting powers are about the same, anthrax] spores resist the action of 5 per cent carbolic acid for 10 hours, but are killed in 15 hours. A five per cent solution of carbolic acid, however, to which 0.5 per cent of hydrochloric acid has been added, destroys them in 2 hours. Bichloride of mercury, 1 to 1000, kills the spores in 3 hours, and in 30 minutes when 0.5 per cent of hydrochloric acid is added to the solution. . . . Tetanus [and anthrax] spores are destroyed with certainty when exposed to dry heat at or above 160° C. for one hour, or to steam at 120° C. for 20 minutes." (Rosenau, "Preventive Medicine and Hygiene," 1913, p. 71.) Organic matter hinders the effect of chemical disinfectants, which must be used in excess in its presence (see p. 576). For the disinfection of hides for anthrax see p. 251. Fortunately the health officer has to deal with these organisms but seldom.

The above are methods readily applicable in any household. In the laboratory and under other special conditions it is feasible to make use of special apparatus and, furthermore, of a most valuable agent — *steam*. Steam is quick, reliable and penetrates deeply. Further, it does more than disinfect; with the few exceptions already noted, it sterilizes.

Either streaming steam or steam under pressure may be used. The former is the principle utilized in the Arnold steam sterilizer or the Koch steamer in the laboratory. When steam is held under pressure its temperature increases and it becomes very highly effective as a sterilizing agent. This fact is made use of in the laboratory digestor or autoclave and in the larger steam disinfecting chambers.

Rosenau [1] states that "streaming steam has the same disinfecting power as boiling water, and an exposure of half an hour to an hour is sufficient. . . . At a pressure of 15 pounds to the square inch steam has a temperature of approximately 120° C. and may be depended upon to sterilize in 20 minutes. At 20 pounds pressure it has a temperature of approximately 125° C. and will sterilize in 15 minutes."

CHEMICAL AGENTS

A. Liquid Disinfectants

Various chemical substances are used, either in solution or in suspension, as disinfectants. We can here mention only the more important and their chief modes of employment. The effect of organic matter in lessening the effects of disinfectants must be borne in mind (see p. 576).

Lime is a cheap and efficient germicide. Lime mixtures must, however, be made from *freshly burned quicklime*, for the reason that lime in any form loses its disinfectant power on standing in contact with air, by being converted into calcium carbonate, which has no germicidal property. Since lime is cheap, it may be used freely so as to insure thorough action.

Convenient Formula [2]

(Milk of Lime)

Slake a quart of freshly burned lime, in small pieces, with three-fourths of a quart of water, or, more exactly, 60 parts of water by

[1] "Preventive Medicine and Hygiene," 1913, p. 982, where a full account of the methods of this class will be found.

[2] The "Convenient Formulæ" given in this Appendix are reprinted from Rosenau's "Preventive Medicine and Hygiene," 1913, p. 1023 f., by permission of D. Appleton and Company. Copyright, 1913, by D. Appleton and Company.

weight with 100 parts of lime. A dry powder of slaked lime (calcium hydroxide) results. Prepare the milk of lime shortly before it is to be used by mixing 1 quart of this dry calcium hydroxide with 4 quarts of water. Air-slaked lime is worthless. Slaked lime may be preserved some time if inclosed in an air-tight container. Milk of lime is especially useful for the disinfection of feces; an equal quantity should be added to the mass and thoroughly mixed.

Since the lime settles to the bottom of the container, the milk of lime should be thoroughly agitated just before use. If necessary to preserve lime mixtures for any length of time they must be kept in *air-tight* containers. It is best prepared fresh each day and kept covered.

If quicklime is used directly without previous addition of water it should be mixed thoroughly with the excreta or other matter to be disinfected, and there should be sufficient liquid present to insure its being fully slaked.[1]

Chlorinated Lime (Hypochlorite of Lime, Calcium Hypochlorite, "Chloride of Lime")[2] is one of the most efficient germicides, and its cost, even at retail, is low. Popularly it is known as "bleaching powder" or, incorrectly, as "chloride of lime." Its efficiency is measured by the amount of available chlorine which it contains; this, according to the U. S. Pharmacopœia, should be not less than 35 per cent. It should be purchased and kept in air-tight containers, for it deteriorates on contact with the air, such deterioration being indicated by a strong odor of chlorine gas (freshly prepared it has only a very slight odor) and a pasty condition of the substance. In this condition its germicidal power is much reduced; it should therefore be used only in a fresh or well-preserved condition.

The dry substance may be used to disinfect excreta. For this purpose, recommends Rosenau, enough of the chlorinated lime must be added and well incorporated with the mass to be equivalent to a 4 or 5 per cent solution.

Convenient Formula[3]

Chlorinated lime.............	3 ounces	. 30 grams
Water.......................	1 gallon	. 1 liter

[1] A method depending upon the heat evolved in the slaking of lime is described by Prausnitz in *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. IV, pt. I, p. 30. See *infra*, p. 584.

[2] For a complete account of the uses of this substance as a disinfectant see Hooker, "Chloride of Lime in Sanitation," John Wiley and Sons, Inc., 1913.

[3] From Rosenau, see note, p. 572.

Mix. This is about a 3 per cent solution. It is exceedingly powerful and is useful for the disinfection of excreta, privy vaults, cesspools and many other purposes. It is an active bleaching agent and destroys fabrics in this concentration.

If kept for any length of time the solution should be placed in a stone jug with tightly fitting stopper, to check deterioration by light and air.

Since chlorinated lime is cheap it may be used freely in excess of theoretical requirements, so as to insure thorough action.

A special use of chlorinated lime is in the disinfection of drinking water (see p. 412).

Carbolic Acid (phenol and allied chemical compounds) is an efficient germicide, though expensive unless the crude variety is used.

Convenient Formula [1]

Crude carbolic acid (or phenol)	7 ounces	. 50 c.c.
Water......................	1 gallon	. 1 liter

The solution is facilitated by dissolving in hot water. This makes approximately a 5 per cent solution. The addition of from 12 to 14 ounces of common salt to each gallon increases its germicidal power, especially when used for the disinfection of excreta. The crude carbolic acid is more powerful than pure phenol, but can only be used for rough work, such as floors, feces, sputum, etc. For the disinfection of clothing phenol should be used and the solution may be mixed half and half with water, making approximately a 2½ per cent solution.

The Cresols are substances related to carbolic acid, such as cresol, creosote, trikresol, etc. They have a smell similar to that of carbolic acid and are efficient germicides, having coefficients higher than pure carbolic acid. Most of the commercial disinfectants on public sale are mixtures in which such substances play the chief part. The "liquor cresolis compositus" of the U. S. Pharmacopœia is a mixture of this class. The various commercial preparations of this kind are too numerous to mention here. Many of them have high coefficients, but they should be subjected to bacteriological test (see p. 589), before being relied upon. Many have been so tested by the Hygienic Laboratory of the U. S. Public Health Service [2] and by various state, city and private laboratories. A great deal is to be said for the cresols as cheap, effective disinfectants having comparatively low poisonous properties.

[1] From Rosenau, see note, p. 572.

[2] Apply to the Hygienic Laboratory for information. Cf. list published in *Hyg. Lab. Bull.*, no. 82.

Bichloride of Mercury (Corrosive Sublimate), a powerful germicide, is a white powder or crystals soluble in water. Solutions may be conveniently prepared from the bichloride tablets sold by druggists. These tablets contain a blue coloring matter to distinguish the solution as highly poisonous. The formula below may also be used. While bichloride is a valuable germicide for certain purposes, being one of the most powerful known to the chemist, it has, in addition to its poisonous character (which makes it especially dangerous when children or careless or ignorant persons have access to it), the disadvantages that its strength is absorbed by organic matter (through precipitation by albuminous substances) and that it attacks metals. Thus its use, while dependable under proper conditions, has certain limitations.

Convenient Formula [1]

Bichloride of mercury........	1 dram	1 gram
Water......................	1 gallon	1 liter

Mix and dissolve. Label "Poison!" This is approximately a 1 to 1000 solution. One ounce of this solution contains very nearly half a grain of corrosive sublimate. Useful for disinfecting clothing, the hands, the surfaces of walls, floors, furniture, etc. Not serviceable for feces or material containing much organic matter.

A little bluing may well be added as a warning as to its poisonous nature. Keep in glass, earthenware or wooden vessels. Do not put into metal receptacles nor pour into metal drains.

Formalin, a solution of formaldehyde gas in water, is one of the most trustworthy and useful germicides available for general use. It is effective, not very poisonous, not injurious to most articles (it has, however, an injurious effect on leather, furs and skins), and in addition acts as a true deodorant. Formalin solution is somewhat unstable and should be kept cool, dark and well corked. Disinfection with formaldehyde gas will be described presently under the head of Gases.

Convenient Formula [1]

Formalin..................	13 ounces	100 c.c.
Water.....................	1 gallon	1 liter

Formalin is a watery solution containing 40 per cent formaldehyde. The above solution contains approximately 10 per cent of formalin and is useful for the disinfection of clothing and a great variety of objects. As it has no corrosive action it does not

[1] From Rosenau, see note, p. 572.

bleach pigments or rot fabrics. When used to disinfect feces twice the above strength should be used.

EFFECTS OF ORGANIC MATTER.[1] — In the use of chemical disinfectants it must be borne in mind that their action may be more or less weakened by organic matter, which may hinder the disinfection process either by chemically absorbing the strength of the disinfectant — as in the case of bichloride of mercury — or, if the organic matter is present in the form of particles, by physically preventing the access of the disinfectant solution to all parts of the substance to be disinfected. The latter is likely to be the case with sputum, feces, thick pus and the like, unless care is taken thoroughly to break up and mix the mass with the disinfectant. Further, it is wise to use an excess of the disinfectant, and to employ those cheap substances, such as cresols, chloride of lime, etc., which may without hesitation be used liberally, though of course such liberality does not dispense from all due care in the operation. Bichloride should never be used for disinfecting organic matter.

B. Gases

Disinfection by gas, popularly called "fumigation," is a measure commonly employed for room disinfection after removal, death or recovery of the patient. The limitations — even absence of value in most cases — of this process have already been discussed in Part II, Chapter I. The methods are here given for what they may be worth and because extreme precaution may at times require this form of disinfection, which is still in very general use.

Effective gaseous disinfection, while it does not penetrate deeply into fabrics and the like, disinfects the *surfaces* upon which infectious matter is lodged or smeared. The object is to disinfect such surfaces and not the air, which (except possibly in some cases for dust), is practically not a vehicle of infection. If proper routine disinfection of discharges and infected articles is carried during the course of a communicable disease and possible infected surfaces washed or wiped off with a liquid disinfectant, it is obvious that terminal disinfection by means of formaldehyde or other gas should be of little or no value and may under such circumstance be discarded as a routine measure (see p. 131 ff.).

Fumigation with sulphur and other special gases, on the other hand, is a valuable measure in exterminating insects.

Formaldehyde. — The chief, and almost the only, gas employed for destruction of pathogenic microörganisms is formaldehyde, which is practically non-poisonous to man and animals and non-destructive.

[1] Cf. reference to standardization of disinfectants with and without organic matter, p. 590.

It is effective to this purpose if applied with attention to all essential details. A great deal, however, of room disinfection as carried out in routine practice at the present time is undoubtedly ineffective, for the reason that insufficient materials are used, the apartment is not properly prepared, or essential conditions as to moisture, temperature, etc., are neglected.[1] Room disinfection requires skill, judgment and care on the part of the disinfector, and directions must be strictly adhered to.

Anything less than thoroughness in gaseous disinfection is a waste of time, labor and materials. Where it is deemed advisable, it is certainly worth carrying out completely in accordance with scientific principles. It should, therefore, not be left to the householder or family physician, but should be performed by an expert official of the health department, and at public expense; thus only can uniformly reliable results be assured.

The first step in practical application is the *preparation of the apartment.* Since the room must be vacated before the disinfection process is applied, it is customary for the patient to take a disinfectant bath and put on fresh clothes, leaving the old ones in the apartment.

First, articles to be disinfected should be distributed about or (e.g., bedding) hung on lines so as to allow free access of the gas, but on the other hand they should not be so much rearranged from the original order as to cover up possibly infected parts. Bureau drawers and closets should be opened and their contents spread out. Articles of little or no value which have been exposed to infection and may be destroyed by fire should be at once so treated.

Second, the room must be properly sealed. Since the amount of gas which may escape even from a well-sealed apartment is much greater than would be supposed, it is essential to make the room as nearly air-tight as possible. Chimneys, registers and other large openings must be closed or tightly stopped up. Cracks and crevices, e.g., the cracks about doors and windows, the keyholes, etc., should be either well caulked (as with paper or cotton), or sealed with adhesive tape. The cracks under doors are likely to be wide and should be thoroughly stopped. When adhesive tape is used the dust should first be wiped from the surfaces to which it is to be applied. Health department adhesive tape about $1\frac{1}{2}$ inches wide is manufactured for the purpose and is very convenient, but care must be taken to see that it is really adhesive after drying. A damp cloth or sponge for moistening the tape and cleaning dusty surfaces is a convenient part of the disinfector's outfit.

[1] See experiments reported in Ann. Rpt. of the State Inspectors of Health of Massachusetts, 1910, pp. 108–120, quoted in *Am. Jour. Pub. Health*, 1912, vol. II, no. 2, p. 131.

All crevices and openings having been stopped up except one door or window left for exit, the operator starts the process for liberating the gas, leaves the room and seals the cracks around the exit door or window on the outside.

The secret of success in any process of formaldehyde disinfection is to liberate a large volume of the gas in a short time and with the right physical conditions. Hence the following requirements: —

1. The amount of material used should be somewhat *in excess* of the estimated requirements, in order to make up for loss by leakage, through conditions not being quite perfect, etc.

2. The gas should be liberated *rapidly*.

3. *Moisture* is necessary, and the more humidity produced the more active the disinfectant action (hence the advantage in processes which liberate more or less moisture).

4. The room should be *warm* — at least comfortable living temperature (65° F.).

If any one of the above conditions is not fulfilled the results may be vitiated.

The *time* necessary varies according to conditions, and since practical conditions are usually not perfectly favorable, an excess of time should be allowed. The least time allowed should be six hours. At the end of the time the gas may be dispelled by opening doors and windows, so far as possible from the outside. If necessary for the operator to enter a room where there is considerable gas he may cover mouth and nose with a wet towel and act quickly, for the gas, though not poisonous, is highly irritating to the mucous membranes of the nose, throat and eyes. The best time to disinfect is at night, for then the room may remain closed over night and in the morning most of the gas will probably be found to have diffused away.

The chief limitation of formaldehyde gas lies in the fact that it does not penetrate to any material extent in fabrics, e.g., bedding and the like; hence if these are to be subjected to more than surface disinfection they should be soaked in disinfectant solution or subjected to some other more penetrating process.

Controls of Disinfection. — The final test of gaseous disinfection is whether the microörganisms present are actually killed. Such a test may readily be carried out by means of a bacteriological "control." If there is any doubt as to the efficiency of a process of disinfection it should be so tested. For this purpose Rosenau recommends saturating threads with an active culture of *B. prodigiosus*. These are attached to little strips of paper which are then exposed in various parts of the room. After the process of disinfection the threads are inoculated into Dunham's peptone medium. If the *B. prodigiosus* has survived the characteristic red color appears in the culture medium.[1]

[1] "Preventive Medicine and Hygiene," 1913, p. 969.

Methods of Formaldehyde Production. — Formaldehyde gas dissolves in water and the solution thus formed, containing about 40 per cent of the gas by weight, is known as formalin (p. 575). The gas may also be condensed into a powder known as paraform. For purposes of disinfection formaldehyde gas may be produced by boiling formalin either under or without pressure or under partial vacuum, by heating paraform powder, by mixing potassium permanganate and formalin (or paraform with water), or by mixing formalin, lime and aluminum sulphate. Formaldehyde disinfection may also be performed by sprinkling articles hung up in the room with formalin solution, which evaporates, thus permeating the room with the gas.

The following are among the more practicable methods of producing the gas:

The Permanganate-paraform Method. — The following method has been tested out by the Department of Health of New York City and found both effective and convenient.[1]

Formula:

Potassium permanganate.......	75 grams	2.5 ounces
Paraformaldehyde (solid formaldehyde in powder form)......	30 grams	1 ounce
Water........................	90 grams	3 ounces

The two chemicals are put up separately in small round paper boxes. A number of these may be prepared at one time and, if dipped in melted paraffin so as to make them air-tight, may be kept on hand in a cool place for some weeks. After a pair of samples have been carefully weighed out small measures may be made and the rest of the amounts may be rapidly measured out by volume. For mixing and for setting off the mixture small deep tin trays (½ quart size) may be used. Where there are many disinfections to be performed it is convenient to use water-tight paper trays 5 or 6 inches square and about 3 inches in depth which may be abandoned after use. Both boxes and trays may be obtained inexpensively if purchased in lots of 500 or 1000 or more from manufacturers of paper goods. The disinfector should be provided with a small measure for water. A unit for each 1000 cubic feet would consist of one box of each chemical and one measure (3 oz.) of water. The two chemicals are thoroughly mixed dry in the tray or trays (several should be used if the apartment contains more than 2000 cubic feet of air space). For safety's sake each paper tray, where these are used, should be placed in a dish or tin pan containing

[1] Schroeder, "Municipal Disinfection in New York City as Recently Reorganized," *Am. Jour. Pub. Health*, 1912, vol. ii, no. 8, p. 591.

warm water to the depth of half an inch or so. Warm water to the quantity required is then added to the contents of each tray and rapidly and thoroughly mixed in with a small glass or wooden rod. The evolution of the gas does not begin at once, so the operator has time to leave the room and seal the door without being annoyed by the fumes. The gas is practically all given off in five to ten minutes. The moisture necessary for efficiency is evolved at the same time. The method has the advantages of efficiency, lightness of materials, convenience of operation and low cost (about 9 cents per unit of 1000 cubic feet). Materials, as with other methods, should, in order to insure thorough action, be used somewhat in excess of estimated requirements.

The Permanganate-formalin Method.[1] — Use 500 c.c. [17 fluid oz.] of formalin and 250 grams [8.8 oz.] of potassium permanganate for each thousand cubic feet of air space. The permanganate is first placed in a bucket or basin and the formalin poured upon it. An active effervescence takes place and considerable heat is evolved; therefore a pail of sufficient capacity, and especially of sufficient height, should be used to prevent splashing or boiling over. In Board of Health work it is advisable to have galvanized iron pails made for this purpose with a flaring top. The floor should be protected against the heat by placing the bucket upon a brick, board, or other suitable device.

When the permanganate of potassium and formalin are brought in contact very active oxidation takes place, with the formation of formic acid and heat. It is the heat that liberates the formaldehyde gas. Chemically, therefore, the method is a wasteful one, but practically a very serviceable one. It was first described by Johnson of Sioux City, Iowa, in 1904. In the same year Evans and Russell of Augusta, Maine, used the method.[2]

The Formalin-lime and Aluminium Sulphate Method.[3] — This method was first described by Walker of the Department of Health, Brooklyn, N. Y. It is somewhat slower than the potassium permanganate method, but otherwise appears to be just as efficient.

[1] This method and the following are reprinted from Rosenau, "Preventive Medicine and Hygiene," 1913, pp. 996–97, by permission of D. Appleton and Company. Copyright, 1913, by D. Appleton and Company.

[2] A convenient permanganate-formalin outfit consisting of a unit for a single room is described by Freeman, *Am. Jour. Pub. Hyg.*, 1909, vol. xxv, p. 361.

[3] Reprinted, by permission, from Rosenau. See note *supra*.

The proportions for each 1000 cubic feet are as follows:

Sol. A. — Aluminium sulphate.....		150 grams	[5.3 oz.]
	Dissolved in hot water....	300 c.c.	[10.2 fluid oz.]
Sol. B. — Formalin (40% CHOH)..		600 c.c.	[20.4 fluid oz.]
Lime. — Unslaked lime...........		2000 grams	[70 oz.]

Mix solutions *A* and *B* and pour upon the lime.

In practical work 20 to 25 pounds of the commercial aluminium sulphate is dissolved in 5 gallons of hot water. This is sufficient to mix with 15 gallons of a 40 per cent formaldehyde solution and then used in the proportions as stated above. The lime should be freshly burned, broken into small particles, and should slake rapidly in cold water. The lime is placed in a large bucket. The formalin and aluminium sulphate solutions should be mixed and poured over the lime. In a few minutes the lime begins to slake and the heat evolved drives off the formaldehyde gas.

Commercial "candles" or "lamps" for the production of formaldehyde from paraform compounds are on the market; some of these are convenient and to a greater or less degree effective. They do not, however, as a rule supply the extra moisture frequently needed. Such articles should be bacteriologically tested as above described before purchasing, and should be retested from time to time in order to detect possible deterioration in manufacture or storage. In selecting a method of disinfection expense must be considered and the unit costs (per thousand cubic feet) of the various methods proposed should be compared. Prices on formalin, permanganate, etc., in bulk will be quoted by wholesale chemical dealers. The strength of formalin is likely to vary below the theoretical 40 per cent solution (average, according to Rosenau, 36 per cent), so that unless its strength is known an excess should be figured. The amount of air space for which each candle is effective, in the case of the commercial "candles," should be determined by bacteriological experiment to check up the manufacturer's statement.

DISINFECTANTS FOR SPECIFIC USES

The choice of a disinfectant in any given case will depend upon: (1) its efficiency and its applicability to the purpose in view; (2) ease of application; (3) cost and (4) disadvantages.

Health authorities should definitely prescribe practical and effective methods of disinfection, and should also supply any needed chemicals in a convenient form at public expense. In many instances this important phase of prevention is slighted and the measures taken are perfunctory and ineffective. The primary responsibility for seeing that disinfection is properly performed throughout the course of each

case of communicable disease rests with the health authorities, whose rules in connection with such cases should be explicit and should be explained and their observance supervised in detail by the sanitary inspector.

The following are the disinfectant agents chiefly to be recommended for certain specific uses. For formulæ and application see preceding pages.

Two rules should be borne in mind throughout:

Disinfection may supplement care and cleanliness in the sick-room and house, but cannot take its place.

Prefer heat (burning and boiling), the simple and universal disinfectant, so far as possible, to other methods.

Sputum, Discharges from Mouth and Nose, etc., should so far as possible be caught on pieces of cloth, gauze, or absorbent cotton, and *burned up*. Destructible sputum cups are useful. Chemical disinfectants, to be allowed to stand in contact half an hour or more: carbolic acid, 5 per cent; formalin, 10 per cent or stronger; chlorinated lime, 3 per cent; but these frequently do not penetrate into particles of sputum, etc. Ordinary cups or cuspidors should contain water, which will hold the sputum until it can be disinfected. Paper cuspidors which can be frequently burnt up and replaced are to be recommended.

Excreta. — Proper disinfection of feces and urine requires care in the application of any of the following methods:[1]

> From patients the discharges should be received in a glass or impervious vessel containing some of the germicidal substance, more of which is added afterwards, and the mass thoroughly mixed. The mixture should stand at least one hour before the contents are disposed of, and the vessel given a thorough cleansing and disinfection before it is again used. At least an equal quantity of the germicidal solution should be used to the mass disinfected and enough should always be added to entirely submerge the mass. Excreta must always be protected from flies and other insects, even while undergoing disinfection.
>
> *Milk of Lime.* — Use freshly prepared milk of lime containing 1 part by weight of the freshly slaked lime to 4 parts of water. Add at least an equal quantity to the amount of material to be disinfected and allow the mixture to stand no less than two hours before final disposal. The perfunctory sprinkling of fecal matter with lime or milk of lime, as is often done, is not effective. Lime should not be thrown into the hoppers of water-closets for the

[1] Reprinted from Rosenau, "Preventive Medicine and Hygiene," 1913, p. 1030, by permission of D. Appleton and Company. Copyright, 1913, by D. Appleton and Company.

disinfection of dejecta, for otherwise a thick mass will accumulate and obstruct the pipes. In disinfecting excreta with lime the reaction of the resulting mixture must be alkaline else the object will not be attained.

Lime or milk of lime is very useful for the disinfection of privies, or trenches in camp, or in country practice. For its use under these circumstances the amount required may be arrived at as follows: The amount of fecal matter per person is reckoned at 400 grams a day. If the urine is also to be disinfected this may be counted as 1500 to 2000 c.c. per person daily. For the disinfection of the solid excrement alone 5 grams of lime, or 40 c.c. of the milk of lime (1 to 8), must be reckoned for each person per day. If the urine is included it will take four to five times as much. The mixture must have an alkaline reaction. Attention is again called to the fact that air-slaked lime is inert.

Chlorinated Lime. — This is one of the most useful and potent germicidal substances for the disinfection of feces. Use at least a 3 per cent solution and an amount equal to the mass to be disinfected. Thoroughly mix and allow to stand at least 2 hours. Chlorinated lime combined with air is rendered inert by organic matter; therefore an excess should always be used.

Formalin. — A 10 per cent solution of formalin may be depended upon to disinfect feces if thoroughly incorporated with the mass and allowed to stand at least one hour. As a deodorant it acts almost instantly.

Carbolic Acid. — A 5 per cent solution of crude carbolic acid added to an equal bulk of excreta may be depended upon to disinfect in one to two hours, provided the germicide is thoroughly incorporated throughout the mass.

The cresols and the alkaline coal-tar creosotes are valuable agents for the disinfection of fecal matter in small amounts on account of their energetic action and because their efficiency is not greatly impaired by the presence of albuminous matter. As a rule substances in emulsion lack the power of penetration, and if used must be very thoroughly mixed and incorporated with the mass.

Dry earth promotes the disinfection of excreta, thus delaying putrefactive changes while absorbing the odors. It has no inherent germicidal qualities. Corrosive sublimate is unfit for the disinfection of feces and sputum.

(For formulæ and details for the use of the above-mentioned disinfectants see pp. 572–5.)

Doty calls attention to the practical difficulties of the ordinary methods of disinfecting excreta by chemical agents, mentions the

necessity for disinfecting the vessel as well as the contents, and recommends the use of *heat*, describing a water-bath which is applicable where the necessary apparatus can be improvised or installed. The method has thus far, apparently, been utilized only in hospitals.

> I believe there is but one way to deal with infected discharges of this kind, if it can be made use of, and that is by heat — either boiling water or steam. Some simple means of performing this may be improvised wherever a metal receptacle of sufficient capacity and a fire can be secured, or a simple and inexpensive apparatus may be made as follows: A sheet-copper receptacle sufficiently large to hold a full-sized bedpan may be easily constructed, having metal supports to raise it above the ground high enough to allow room for a lamp or gas apparatus to secure the necessary heat. The cover should, if possible, be made sufficiently heavy to offset a slight pressure of steam. This, however, is still further provided for by a spout which is attached to the portion of the top not involved in the cover and for the same purpose that a spout is used on a teakettle — to allow the escape of steam. The upper end of this should be connected with a flexible tube, which may be carried out of the window in order that the steam does not escape into the apartment itself. When not used the temperature of the water may be kept short of the boiling point. The addition of a small amount of potassium permanganate will usually prevent any unpleasant odor. The value of this method lies in the fact that when the bedpan is brought from the patient and placed in the bath and exposed to boiling water for 20 minutes we may be certain that both the pan and the discharge are disinfected and it makes little difference what is done with them afterwards. This apparatus is only a suggestion of the principle which may be carried out on a larger scale. In the hospitals which have been under my direction large apparatus were constructed along these lines capable of holding eight bedpans at one time. Steam may be used instead of boiling water. This method of disinfection is valuable in any form of infectious disease for the treatment of discharges or textile fabrics or other articles which may have been directly contaminated.[1]

Slaking of Quicklime. — What is apparently the most effective method of all for the disinfection of excreta consists in making use of the *heat* evolved in the *slaking of quicklime.*[2] It consists in add-

[1] Doty, *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. IV, pt. I, p. 17.

[2] Prausnitz, *Trans. XV Internat. Congress Hyg. and Demogr.*, 1912, vol. IV, p. 30; H. Linenthal and H. N. Jones, *Boston Med. and Surg. Jour.*, Jan. 8, 1914 (reprinted in Mo. Bull. Mass. State Bd. Health, Jan., 1914.

ing enough hot water to cover the stool in the receptacle and then adding an amount equal to at least one-fourth of the entire bulk of liquid present — or about a cupful — of quicklime, covering the receptacle and allowing it to stand for two hours. The slaking of the lime generates enough heat to destroy intestinal organisms. The water added should have a temperature of at least 50°–60° C. (120°–140° F.); cold water cannot be depended upon. A porcelain vessel retains the heat better than a metal one. The lime should be broken up into small fragments and distributed evenly over the stool. The method is simple and is applicable in the household. If necessary, water should be heated in the sick-room, in order to avoid any communication with the kitchen for that purpose. Use fresh unslaked lime which has been protected from the air; old, air-slaked lime is inert.

The Hands. — Disinfection of the hands of persons nursing cases of communicable disease is of prime importance. Chronic carriers of disease should also take precautions to keep their hands free from infection, which means that the hands must be disinfected after every exposure to contamination.

To free the hands from infection does not require elaborate measures. In the first place, *thorough washing* with soap and water, followed by rinsing in running water and thorough wiping, results, as experiment has shown, in freeing the hands from microörganisms. The operation as performed by careful persons under ordinary circumstances would remove at least the great majority of germs. This is a fact of importance to all persons who desire to protect themselves from the contact infection which, as we have pointed out in the discussion in previous pages, is readily conveyed, from known or unknown sources, by contaminated fingers. Dirty hands, even though the dirt is unseen, spell danger at all times; clean hands, relative safety. But, since most persons cannot be depended upon to be sufficiently careful, it is well, where there is question of protection from known infection, to practice *chemical disinfection* as a safeguard.

In connection with cases of communicable disease, the nurse should first carefully wash her hands, then dip them for not less than one full minute by the clock in a solution of bichloride, carbolic acid ($2\frac{1}{2}$ per cent) or one of the cresols, alcohol, eau-de-Cologne or other suitable disinfectant; the disinfectant should then be rinsed off with clean water and the hands should be wiped dry with a towel used for no other purpose. The process should be repeated after each handling of patient, infectious matter or infected articles.

Care should be taken that the hands do not become unconsciously recontaminated by handling infected vessels or articles, and the waste

water resulting from the above process should be disposed of so as to occasion no danger of infection, disinfectant being added to it if necessary.

Chronic Carriers of typhoid or other disease should be instructed to take similar precautions after every possible contamination of the fingers; thorough washing and wiping of the hands is the least that should be demanded, preferably followed with the use of a disinfectant.

Dishes and Other Eating Utensils should be placed in a metal vessel (e.g., a dish-pan) and entirely covered with water. This vessel should be kept outside of the sick-room door and twice a day it should be removed to the kitchen stove and its contents well boiled in the same vessel for twenty minutes. The use of chemical agents is not necessary.

Body and Bed Linen should be similarly treated in a separate vessel such as an ordinary washboiler. During the boiling the materials should be agitated so as to insure penetration of the boiling water to all parts. With such a process no chemicals are necessary.

Bedding, such as blankets, mattresses, etc., which cannot be boiled, may be thoroughly sprayed on all parts with formalin and shut up in a warm and tight closet, box, or drawer for at least 12 hours and then should be exposed to sun and air. A gaseous formaldehyde disinfection will disinfect the *surfaces* of such things if they are exposed so that the surfaces may be reached by the gas. Some health departments in the larger cities remove bedding, disinfect it by steam, and then return it.

Miscellaneous Articles, if of little or no value, may be burned. Or they may be boiled or immersed in a disinfectant solution. Or each article may be sprayed with formalin by means of a hand atomizer and placed in a wooden or pasteboard box having a tight-fitting cover, which should be sealed and kept in a warm room for twelve hours. Articles which would be injured by much moisture may be placed in a tight box or compartment and subjected to formaldehyde gas with a moderate amount of moisture. Magazines and books which have been used in the sick-room may, if of little value, be burned, or may be disinfected as described below. In boiling bright metal objects the addition of a small amount of alkali, e.g., cooking or washing soda, will prevent corrosion.

Books may be disinfected externally by formaldehyde gas and internally by placing two or three drops of formalin solution on every second page, with care to distribute the drops well. The book is then placed in a tight box or drawer in which more formalin has been sprinkled and left in a warm place for not less than 24 hours. The following method, adaptable to larger numbers of books, is given by Dr. Robert J. Wilson, Superintendent of Hospitals of the Department of Health of New York.

> Books can be successfully disinfected by formaldehyde fumigation. In order to insure thorough fumigation the books must be so arranged as to insure penetration of the gas between all the pages. This is best accomplished by opening the book until the covers come together at the back, holding them in this position by a rubber band or clothespin. This will cause the leaves to separate and allow the gas to pass between them. The books should then be placed on perforated shelves, preferably made of wire netting, standing on end. Formaldehyde gas, [derived from] 40 per cent [formalin] solution, from any kind of an approved generator, in the proportion of 1 ounce of solution for every 100 cubic feet of space, should be supplied in an air-tight box that contains the books. The exposure to the gas should not be less than four hours. Test organisms of common pathogenic organisms exposed under these conditions have been destroyed by the action of the gas.[1]

The internal disinfection of books is usually of little practical value.

Surfaces, such as woodwork, furniture, and the like, unless directly exposed to infection by smearing, handling, coughing, etc., need no general treatment. For door-knobs, bed-frames, and other parts which have been exposed, the cresol compounds are to be recommended; also bichloride solution and other liquid disinfectants. Washing or scrubbing with soap and water with the addition of a cresol is useful. With such exceptions treatment of woodwork, etc., is unnecessary if cleanliness has been observed during isolation.

Terminal or Room Disinfection. — If the above-mentioned measures have been carried out, general room disinfection should be unnecessary as a terminal routine measure (see discussion in Part II, Chapter I). If proper care has been exercised during the isolation there will only remain a few articles and surfaces in the sick-room which can possibly require disinfection, and these can be dealt with as already described. At the present time terminal disinfection with formaldehyde gas can only be regarded either as an endeavor to atone for lack of proper measures during the course of the disease or as an extreme precaution when such measures have been taken. (Methods have been given a few pages back.)

[1] *Jour. Outdoor Life*, 1914, vol. xi, no. 4, p. 118. Other methods of book disinfection, especially for larger numbers of books, are given in Rosenau's "Preventive Medicine and Hygiene," 1913, p. 1033. Moist hot air in a specially constructed chamber has been recommended by Nice, *Jour. Am. Pub. Health Assn.*, 1911, vol. i, no. 11, p. 775, and *Jour. Am. Med. Assn.*, 1912, vol. lviii, no. 16, p. 1201.

Stables are difficult to disinfect thoroughly, but disinfection may be necessary on account of glanders, tuberculosis and other animal diseases transmissible to man. The disinfection should be accompanied by a thorough cleaning and a cleansing of all surfaces. Rosenau recommends: first, sulphur fumigation (see below) to destroy surface infection and vermin, followed by burning or disinfection of such as harness, blankets, combs, etc., by appropriate methods; then a liberal application of an antiseptic solution (e.g., a cresol compound); then cleaning woodwork with hot lye or strong alkaline soap solution followed by another application of disinfectant. After several days exposure to air and sunshine the interior should receive a fresh coat of whitewash, applied quickly, and prepared from freshly burned lime. Watering troughs and the water contained in them may require disinfection, the disinfectant being afterwards thoroughly washed out. Ground may be disinfected with fresh quicklime. Carcasses and excreta may be buried in quicklime.[1]

SULPHUR FUMIGATION

Sulphur fumigation is highly efficient for the destruction of insects and vermin.[2] Although it is not a very efficient germicide it has also a certain value in destroying surface infection. Sulphur is cheap and may be obtained even in country stores, and the application is simple.

As a germicide sulphur dioxide (the gas formed by combustion of sulphur) requires moisture. It does not penetrate, however, and is therefore only useful for surface disinfection. It does not kill spores.

As an insecticide it does not require moisture, and penetrates very effectively. It quickly kills all forms of insect and animal life, e.g., mosquitoes, flies, fleas, rats, etc. (On mosquito destruction cf. p. 592.)

Its disadvantages are that it bleaches colors, corrodes metals and tends to disintegrate fabrics, and the more moisture there is present the more pronounced are these effects. Metal surfaces may, however, be protected by a thin coating of heavy oil or grease (e.g., vaseline); while if exposed fabrics are at once washed most of the damage to them can be avoided.

[1] For more detailed account of methods above outlined, see Rosenau, "Preventive Medicine and Hygiene," 1913, p. 1027.

[2] Hydrocyanic acid gas (prussic acid) is highly efficacious against insects and vermin, but as it is extremely poisonous to human beings it must be used with special precautions and great care; hence, while it may only be used in special classes of buildings, it has a very limited place as an insecticide in the disinfection of dwelling houses. See Dept. of Rosenau, "Preventive Medicine and Hygiene," 1913, p. 194. The U. S. Dept. of Agriculture publishes instructions for its use.

The *pot method*, described below, is recommended. Similar conditions to those required for formaldehyde disinfection should be obtained if germicidal action is desired, viz., a well-sealed room, sufficient moisture and at least comfortable room temperature. To insure insecticidal action the sealing of the compartment is also important (see page 592). The gas is evolved slowly and if there are many cracks and crevices may escape nearly as rapidly as evolved. At low temperatures a good deal of the gas may be condensed by the moisture present.

> The pot method is at once the easiest, cheapest and probably most efficient method of using sulphur dioxide. The only materials required are iron pots and some sulphur. The best way to apply the method is by placing the sulphur in large, flat, iron pots known as Dutch ovens. Not more than 30 pounds of sulphur should be placed in each pot. The sulphur is preferably used in the form of flowers of sulphur. If it is in sticks or rolls it should be crushed into a powder, which may conveniently be done by placing the sulphur in a stout box and pounding the lumps with a heavy timber. The pot holding the sulphur should be placed in a tub of water [being raised on supports off the bottom of the latter]. The water not only diminishes the danger from fire and protects the floor, but by its evaporation furnishes the moisture necessary to hydrate the sulphur dioxide, upon which the disinfecting power of the gas depends. Thus the moisture is furnished automatically and does away with the necessity for its introduction by means of steam or a spray. Although the specific gravity of sulphur dioxide is greater than that of air, when hot it rises, aided by the upward current produced by the burning sulphur. Hence the pots should not be on the floor, or at the bottom of the hold in the case of vessels, lest the cold gas settle and the flame, being deprived of oxygen, be extinguished before all the sulphur is burned. The pots may therefore be placed upon a table or box or, in the holds of ships, upon piles of ballast or on the "'tween decks."
>
> The sulphur may be lighted by means of hot coals or a wood fire, but the most reliable way to get it well lighted is by alcohol, turpentine, or kerosene on a pledget of waste. Make a little crater of the sulphur, soak liberally with alcohol, and ignite. The sulphur then burns in the center, and as it melts runs down from the sides and forms a little lake at the bottom of the crater. If the sulphur is heaped up in a mound in the pot the flame is liable to go out.
>
> Upon the principle of not putting all our eggs in one basket, it is best to have a number of pots when a large compartment is to be fumigated. A pot should contain not more than 30 pounds of

sulphur, and the pots should be well distributed in various portions of the place to be disinfected.

Use 5 pounds per 1000 cubic feet where a germicidal action is desired, and at least 2 pounds per 1000 cubic feet for insecticidal purposes. For the destruction of bacteria an exposure of from 6 to 24 hours is necessary, while for the destruction of vermin from 2 to 12 hours is sufficient, depending upon the size and shape of the compartment to be treated.[1]

STANDARDIZATION OF DISINFECTANTS

Disinfectants may be bacteriologically standardized by the method originated by Rideal and Walker, and modified by the U. S. Hygienic Laboratory and others, which gives the strength of the disinfectant as compared with carbolic acid taken as a standard. The figure thus obtained is known as the "carbolic (or phenol) coefficient."[2]

Local health authorities may rely upon substances of known value, but if there is any question or a new disinfectant is to be adopted, it should be tested by some competent authority, such as a state laboratory or the Hygienic Laboratory of the U. S. Public Health Service at Washington. The latter has already tested a number of commercial disinfectants, some of which were found to have little or no value (Bull. no. 82). The question of expense also enters in, and the cost of the commercial preparation in question, even though efficient, should be compared with that of the ordinary disinfecting substances.

HOUSEHOLD DISINFECTANTS AND DEODORANTS

A number of commercial preparations are sold as "household disinfectants," being alleged to free the house in a general way from infection. It scarcely needs be repeated that the best prophylactic measure

[1] Reprinted from Rosenau, "Preventive Medicine and Hygiene," 1913, pp. 997 ff. (where other methods are also described), by permission of D. Appleton and Company. Copyright, 1913, by D. Appleton and Company.

[2] See Rosenau, "Preventive Medicine and Hygiene," 1913, p. 974; Anderson and McClintock, Method of Standardizing Disinfectants with and without Organic Matter, with determination of the phenol coefficient of some commercial disinfectants, Bull. no. 82, Hyg. Lab., Wash., 1912; Worth Hale, Method for Determining the Toxicity of Coal-tar Disinfectants, with report on relative toxicity of some commercial disinfectants, Bull. no. 88, Hyg. Lab., Wash.; and papers and reports of special Committee in *Am. Jour. Pub. Health* for 1912, *et seqq.* The matter is now in the hands of an international committee appointed at the International Congress of Hygiene and Demography and International Congress of Applied Chemistry in 1912.

of general availability is domestic cleanliness, — avoidance of dissemination of filth, and a plentiful use of soap and water supplemented by air and sunlight. Under normal circumstances and except as ordered by health authorities it is practically unnecessary to keep powerful chemical disinfectants in the house, and some (as bichloride of mercury) are poisonous. Where antiseptics are needed coal-tar substances (cresols), being comparatively non-poisonous, may be used. Money should not be wasted on worthless "household disinfectants," a number of which are on the market.

The absurd idea that aromatic vapors or disinfectants placed in saucers about a sick-room purify the air should be deprecated as a fetish, distracting attention from matters of real importance. Any needful purification of the air can be accomplished by cleanliness and airing. Instead of neglecting cleanliness and attempting to mask, neutralize or absorb foul odors by the use of "disinfectants," they should be traced to their source and the latter removed, or, if necessary, treated as mentioned below.

Under certain circumstances, when freedom from bad odors in and about toilet fixtures, garbage pails, cellars, etc., cannot be entirely secured by measures of cleanliness, the use of a *deodorant* is justifiable.

Chloride of lime acts as a deodorant as well as a disinfectant. The odor of chlorine which it emits is, however, disagreeable to sensitive noses.

A common, cheap and effective deodorant is *lime*. The use of lime (or any other deodorant) in the form of powder is not satisfactory for the reason that a thorough admixture with the substance to be deodorized frequently cannot readily be secured. Ordinary whitewash or milk of lime made from freshly burnt quicklime is a good deodorant as well as a disinfectant. Glue is frequently added to whitewash to increase its adhesiveness.

Lime combined with copper is even more effective. Doty recommends a formula of one pound of copper sulphate ("blue vitriol," *not* "copperas"), one pound of unslaked lime ("rock-lime") and ten gallons of water, which may be prepared as follows at a cost of about eight cents per ten gallons:

> In preparing the mixture . . . it is advisable to first dissolve the copper by placing it in a linen bag suspended by a string just below the surface of the water. In this way it is dissolved much more rapidly than when the copper is thrown in the bottom of the receptacle and stirred. For example, the copper may be dissolved in six or eight gallons of water, leaving the remainder of the ten gallons to prepare the lime, which is done by placing the latter dry in the pail or other receptacle and gradually adding

water and stirring until the "steaming" or "slaking" is completed. The lime is then gradually added to the water in which the copper has already been dissolved, the mixture being constantly stirred during this time; a precipitation then takes place. In a tightly-covered receptacle the mixture may be kept indefinitely as a stock solution, always to be well stirred before using.[1]

The deodorizing principle exists in the precipitate, hence the mixture must be kept stirred during use. It may be applied with brush or sprinkling pot with enlarged holes in the nozzle. Offensive liquids may be deodorized by admixture of the lime-copper solution in the proportion of one gallon to 30 to 50 gallons, estimated.

As a safe and simple household deodorant about woodwork and the like formalin may be used. It has the further advantage of being a germicide. Formalin may be obtained in small quantities from any druggist. It should be kept in a cool, dark place. It is inexpensive if diluted and sparingly used, little being necessary for deodorization.

INSECTICIDES

For sulphur, which is the best general fumigant for insects, see page 588.

For killing *mosquitoes* in houses where sulphur fumes would be objectionable Mim's culicide, composed of equal parts of phenol crystals and camphor thoroughly combined, is useful. The material is evaporated from an earthenware basin over an alcohol lamp, in the amount of 4 ounces per thousand cubic feet. If necessary, use several sets of apparatus, — not more than 8 or 10 ounces to each. The space should be left closed for at least one, and better, two hours. Care should be taken that the compound does not catch fire, the basin being placed at a proper distance above the flame. The apparatus should be placed in a pan containing half an inch of water, and previous experiments should be made to assure safe and proper working. A ventilated support for the evaporating basin, made of a section of stove pipe, is a useful adjunct as a protection against drafts. The fumes do not affect metals, fabrics and paints as does sulphur, though varnishes may be softened. They are somewhat irritating but not especially poisonous. The insects are stunned but not always killed; hence they should be swept up and burned directly after the fumigation.

In all insecticidal fumigation the apartment should be *sealed* as completely as possible (see page 577 f.) and crevices and folds in fabrics, etc., where the insects may escape or take cover, should be stopped up or removed. If all windows are covered but one, the insects will seek the light and tend to collect there.

[1] "Prevention of Infectious Diseases," 1911, pp. 202–09.

REFERENCES

A detailed discussion of disinfection theory and methods, also of insect extermination, will be found in Rosenau's "Preventive Medicine and Hygiene," 1913, upon which many of the statements in the foregoing condensed treatment of the subject are based.

Cf. also: Doty, "Prevention of Infectious Diseases," 1911; Whipple, "Typhoid Fever," 1908 (appendix).

APPENDIX B

STANDARD RULES FOR THE PRODUCTION, HANDLING AND DISTRIBUTION OF MILK

(Commission on Milk Standards of the New York Milk Committee, 1913)[1]

As a basis for the promulgation of rules and recommendations governing the production, handling and distribution of milk, it is recognized that we have to deal with two kinds of milk, raw and pasteurized, although there may be several grades of each of these two kinds. In order for any grade to be safe, it is recommended that the regulations herein set forth under the heading "Requirements" be enforced. The regulations herein set forth under the heading "Recommendations" should be adopted wherever practicable as a means of improving the milk supply above the actual point of safety. (The term "milk" shall be construed to include the fluid derivatives of milk wherever such construction of the term is applicable.)

LICENSES

Requirements

No person shall engage in the sale, handling, or distribution of milk in ——— until he has obtained a license therefor from the health authorities. This license shall be renewed on or before the 1st day of ——— of each year and may be suspended or revoked at any time for cause.

Recommendations

The application for the license shall include the following statements:
(1) Kind of milk to be handled or sold.
(2) Names of producers with their addresses and permit numbers.
(3) Names of middlemen with their addresses.

[1] This entire Appendix is reprinted from Reprint No. 141 from the Public Health Reports, U. S. Public Health Service, Aug. 22, 1913. The committee holds frequent meetings, and additional resolutions are recorded in its annual reports published in the Public Health Reports.

(4) Names and addresses of all stores, hotels, factories and restaurants at which milk is delivered.

(5) A statement of the approximate number of quarts of milk, cream, buttermilk and skim milk sold per day.

(6) Source of water supply at farms and bottling plants.

(7) Permission to inspect all local and out-of-town premises on which milk is produced and handled.

(8) Agreement to abide by all the provisions of State and local regulations.

PERMITS

Requirements

No person shall engage in the production of milk for sale in ——, nor shall any person engage in the handling of milk for shipment into ——— until he has obtained a permit therefor from the health authorities. This permit shall be renewed on or before the 1st day of ——— of each year and may be suspended or revoked at any time for cause.

I. RAW MILK

COW STABLES

Requirements

1. They shall be used for no other purpose than for the keeping of cows, and shall be light, well ventilated and clean.
2. They shall be ceiled overhead if there is a loft above.
3. The floors shall be tight and sound.
4. The gutters shall be water-tight.

Recommendations

1. The window area shall be at least 2 square feet per 500 cubic feet of air space and shall be uniformly distributed, if possible. If uniform distribution is impossible, sufficient additional window area must be provided so that all portions of the barn shall be adequately lighted.
2. The amount of air space shall be at least 500 cubic feet per cow, and adequate ventilation besides windows shall be provided.
3. The walls and ceilings shall be whitewashed at least once every six months, unless the construction renders it unnecessary, and shall be kept free from cobwebs and dirt.
4. All manure shall be removed at least twice daily, and disposed of so as not to be a source of danger to the milk either as furnishing a breeding place for flies or otherwise.
5. Horse manure shall not be used in the cow stable for any purpose.

MILK ROOM

Requirements

Every milk farm shall be provided with a milk room that is clean, light and well screened. It shall be used for no other purpose than for the cooling, bottling and storage of milk and the operations incident thereto.

Recommendations

1. It shall have no direct connection with any stable or dwelling.
2. The floors shall be of cement or other impervious material, properly graded and drained.
3. It shall be provided with a sterilizer unless the milk is sent to a bottling plant, in which case the cans shall be sterilized at the plant.
4. Cooling and storage tanks shall be drained and cleaned at least twice each week.
5. All drains shall discharge at least 100 feet from any milk house or cow stable.

COWS

Requirements

1. A physical examination of all cows shall be made at least once every six months by a veterinarian approved by the health authorities.
2. Every diseased cow shall be removed from the herd at once and no milk from such cows shall be offered for sale.
3. The tuberculin test shall be applied at least once a year by a veterinarian approved by the health authorities.
4. All cows which react shall be removed from the herd at once, and no milk from such cows shall be sold as raw milk.
5. No new cows shall be added to a herd until they have passed a physical examination and the tuberculin test.
6. Cows, especially the udders, shall be clean at the time of milking.
7. No milk that is obtained from a cow within 15 days before or 5 days after parturition, nor any milk that has an unnatural odor or appearance, shall be sold.
8. No unwholesome food shall be used.

Recommendations

1. Every producer shall allow a veterinarian employed by the health authorities to examine his herd at any time under the penalty of having his supply excluded.
2. Certificates showing the results of all examinations shall be filed with the health authorities within 10 days of such examinations.

3. The tuberculin tests shall be applied at least once every six months by a veterinarian approved by the health authorities, unless on the last previous test no tuberculosis was present in the herd or in the herds from which new cows were obtained, in which event the test may be postponed an additional six months.

4. Charts showing the results of all tuberculin tests shall be filed with the health authorities within 10 days of the date of such test.

5. The udders shall be washed and wiped before milking.

EMPLOYEES

Requirements

1. All employees connected in any way with the production and handling of milk shall be personally clean and shall wear clean outer garments.

2. The health authorities shall be notified at once of any communicable disease in any person that is in any way connected with the production or handling of milk, or of the exposure of such person to any communicable disease.

3. Milking shall be done only with dry hands.

Recommendations

1. Clean suits shall be put on immediately before milking.

2. The hands shall be washed immediately before milking each cow, in order to avoid conveyance of infection to the milk.

UTENSILS

Requirements

1. All utensils and apparatus with which milk comes in contact shall be thoroughly washed and sterilized, and no milk utensil or apparatus shall be used for any other purpose than that for which it was designed.

2. The owner's name, license number, or other identification mark, the nature of which shall be made known to the health authorities, shall appear in a conspicuous place on every milk container.

3. No bottle or can shall be removed from a house in which there is, or in which there has recently been, a case of communicable disease until permission in writing has been granted by the health authorities.

4. All metal containers and piping shall be in good condition at all times. All piping shall be sanitary milk piping, in couples short enough to be taken apart and cleaned with a brush.

5. Small-top milking pails shall be used.

Recommendations

1. All cans and bottles shall be cleaned as soon as possible after being emptied.

2. Every conveyance used for the transportation or delivery of milk, public carriers excepted, shall bear the owner's name, milk-license number and business address in uncondensed gothic characters at least 2 inches in height.

MILK

Requirements

1. It shall not be strained in the cow stable, but shall be removed to the milk room as soon as it is drawn from the cow.

2. It shall be cooled to 50° F. or below within two hours after it is drawn from the cow and it shall be kept cold until it is delivered to the consumer.

3. It shall not be adulterated by the addition to or the subtraction of any substance or compound, except for the production of the fluid derivatives allowed by law.

4. It shall not be tested by taste at any bottling plant, milk house, or other place in any way that may render it liable to contamination.

5. It shall be bottled only in a milk room or bottling plant for which a license or permit has been issued.

6. It shall be delivered in bottles, or single service containers, with the exception that 20 quarts or more may be delivered in bulk in the following cases:

(*a*) To establishments in which milk is to be consumed or used on the premises.

(*b*) To infant-feeding stations that are under competent medical supervision.

7. It shall not be stored in or sold from a living room or from any other place which might render it liable to contamination.

Recommendations

1. It shall be cooled to 50° F. or below immediately after milking and shall be kept at or below that temperature until it is delivered to the consumer.

2. It shall contain no visible foreign material.

3. It shall be labeled with the date of production.

RECEIVING STATIONS AND BOTTLING PLANTS

Requirements

1. They shall be clean, well screened and lighted, and shall be used for no other purpose than the proper handling of milk and the opera-

tions incident thereto, and shall be open to inspection by the health authorities at any time.

2. They shall have smooth, impervious floors, properly graded and drained.

3. They shall be equipped with hot and cold water and steam.

4. Ample provision shall be made for steam sterilization of all utensils, and no empty milk containers shall be sent out until after such sterilization.

5. All utensils, piping and tanks shall be kept clean and shall be sterilized daily.

Recommendations

1. Containers and utensils shall not be washed in the same room in which milk is handled.

STORES

Requirements

1. All stores in which milk is handled shall be provided with a suitable room or compartment in which the milk shall be kept. Said compartment shall be clean and shall be so arranged that the milk will not be liable to contamination of any kind.

2. Milk shall be kept at a temperature not exceeding 50° F.

Recommendations

1. Milk to be consumed off the premises may be sold from stores only in the original unopened package.

GENERAL REGULATIONS

Requirements

1. The United States Bureau of Animal Industry score card shall be used, and it is recommended that dairies from which milk is to be sold in a raw state shall score at least 80 points.

2. Every place where milk is produced or handled and every conveyance used for the transportation of milk shall be clean.

3. All water supplies shall be from uncontaminated sources and from sources not liable to become contaminated.

4. The license or permit shall be kept posted in a conspicuous place in every establishment for the operation of which a milk license or permit is required.

5. No milk license or permit shall at any time be used by any person other than the one to whom it was granted.

6. No place for the operation of which a license or permit is granted shall be located within 100 feet of a privy or other possible source of

contamination, nor shall it contain or open into a room which contains a water-closet.

7. No skim milk or buttermilk shall be stored in or sold from cans or other containers unless such containers are of a distinctive color and permanently and conspicuously labeled " skim milk " or " buttermilk," as the case may be.

8. No container shall be used for any other purpose than that for which it is labeled.

Recommendations

1. Ice used for cooling purposes shall be clean and uncontaminated.

2. No person whose presence is not required shall be permitted to remain in any cow stable, milk house or bottling room.

SUBNORMAL MILK

Requirements

1. Natural milk that contains less than 3.25 per cent, but more than 2.5 per cent milk fat, and that complies in all other respects with the requirements above set forth, may be sold, provided the percentage of fat does not fall below a definite percentage that is stated in a conspicuous manner on the container; and further provided that such container is conspicuously marked " substandard milk."

CREAM

Requirements and Recommendations

1. It shall be obtained from milk that is produced and handled in accordance with the provisions hereinbefore set forth for the production and handling of milk.

STANDARDS FOR MILK

Requirements

1. It shall not contain more than 100,000 bacteria per cubic centimeter.

2. It shall contain not less than 3.25 per cent milk fat.

3. It shall contain not less than 8.5 per cent solids not fat.

Recommendations

1. The bacterial limit shall be lowered if possible.

STANDARDS FOR CREAM

Requirements

1. There shall be a bacterial standard for cream corresponding to the grade of milk from which it is made and to its butter-fat content.

2. It shall contain not less than 18 per cent milk fat.

Recommendations

Same as above for milk.

STANDARDS FOR SKIM MILK

Requirements

1. It shall contain not less than 8.75 per cent milk solids.

2. Control of sale of skim milk: Whether skim milk is sold in wagons or in stores all containers holding skim milk should be painted some bright, distinctive color and prominently and legibly marked "skim milk." When skim milk is placed in the buyer's container, a label or tag bearing the words "skim milk" should be attached.

II. PASTEURIZED MILK

Pasteurized milk is milk that is heated to a temperature of not less than 140° F. for not less than 20 minutes, or not over 155° F. for not less than 5 minutes, and for each degree of temperature over 140° F. the length of time may be 1 minute less than 20. Said milk shall be cooled immediately to 50° F. or below and kept at or below that temperature.

COW STABLES

Requirements and recommendations same as for raw milk.

MILK ROOM

Requirements and recommendations same as for raw milk.

COWS

Requirements

The same as for the production of raw milk, with the exception of the sections relating to the tuberculin test.

Recommendations

That no cows be added to a herd excepting those found to be free from tuberculosis by the tuberculin test.

EMPLOYEES

Requirements and recommendations same as for raw milk.

UTENSILS

Requirements and recommendations same as for raw milk.

MILK FOR PASTEURIZATION

Requirements

1. The same as for the production of raw milk, with the exception of sections 1, 2 and 6*b*.

2. It shall be cooled to 60° F. or below within two hours after it is drawn from the cow, and it shall be held at or below that temperature until it is pasteurized. After pasteurization, it shall be held at a temperature not exceeding 50° F. until delivered to the consumer.

3. Pasteurized milk shall be distinctly labeled as such, together with the temperature at which it is pasteurized and the shortest length of exposure to that temperature and the date of pasteurization.

Recommendations

1. No milk shall be repasteurized.

2. The requirements governing the production and handling of milk for pasteurization should be raised wherever practicable.

PASTEURIZING PLANTS

Requirements

The same as under " Receiving stations and bottling plants " for raw milk.

Recommendations

The same as under " Receiving stations and bottling plants " for raw milk.

STORES

Requirements and recommendations same as for raw milk.

GENERAL REGULATIONS

Requirements

1. It is recommended that dairies producing milk which is to be pasteurized shall be scored on the United States Bureau of Animal Industry score card, and that health departments, or the controlling departments whatever they may be, strive to bring these scores up as rapidly as possible.

2. Milk from cows that have been rejected by the tuberculin test, but which show no physical signs of tuberculosis, as well as those which have not been tested, may be sold provided that it is produced and handled in accordance with all the other requirements herein set forth for pasteurized milk.

3. Ice used for cooling purposes shall be clean.

Recommendations

The same as for raw milk.

PASTEURIZED CREAM

Requirements

1. It shall be obtained only from milk that could legally be sold as milk under the requirements hereinbefore set forth.

2. Pasteurized cream, or cream separated from pasteurized milk, shall be labeled in the manner herein provided for the labeling of pasteurized milk.

STANDARDS FOR PASTEURIZED MILK

Requirements

1. It shall not contain more than 1,000,000 bacteria per cubic centimeter before pasteurization, nor over 50,000 when delivered to the consumer.

2. The standards for the percentage of milk fat and of total solids shall be the same as for raw milk.

Recommendations

1. The limits for the bacterial count before pasteurization and after pasteurization should both be lowered if possible.

STANDARDS FOR PASTEURIZED CREAM

Requirements

1. No cream shall be sold that is obtained from pasteurized milk that could not be legally sold under the provisions herein set forth, nor shall any cream that is pasteurized after separation contain an excessive number of bacteria.

2. There shall be a bacterial standard for pasteurized cream corresponding to the grade of milk from which it is made and to its butter-fat content.

3. The percentage of milk fat shall be the same as for raw cream.

PENALTY

Every milk ordinance should contain a penalty clause.

APPENDIX C

LEGAL DECISIONS REGARDING THE TUBERCULIN TEST

The decision of the Supreme Court of New Jersey by which the right of the Board of Health of Montclair, N. J., to require the tuberculin-testing of dairy cattle was affirmed, is of such importance, not only for its bearing upon the status of the tuberculin test but also as a general comment upon the powers of local authorities in the supervision of food supplies, that the principal points of the decision are here given.[1]

Below is the section of the Sanitary Code of Montclair which the company contesting the regulation sought to have set aside:

> " No milk[2] shall be sold or offered for sale or distributed in the town of Montclair except from cows in good health, nor unless the cows from which it is obtained have within one year been examined by a veterinarian whose competency is vouched for by the State Veterinary Association of the State in which the herd is located, and a certificate signed by such veterinarian has been filed with the board of health, stating the number of cows in each herd that are free from disease. This examination *shall include the tuberculin test*, and charts showing the reaction of each individual cow shall be filed with this board. All cows which react shall be removed from the premises at once if the sale of milk is to continue, and no cows shall be added to a herd until a certificate of satisfactory tuberculin tests of said cows have been filed with this board."

(The Board had previously required simply physical veterinary examinations.)

[1] For further details see Rpt. Montclair Board of Health for 1911 (containing complete decision and review of case) and preceding years back to 1907, when the contested ordinance was adopted; and Wells, " The Successful Efforts of a Small City to Secure a Milk Supply from Tuberculin-Tested Cows," *Am. Jour. Pub. Health*, 1912, vol. ii, no. 9, p. 702.

[2] Under another section of the ordinance the same requirements apply to cream.

By an amendment adopted a little later, pasteurization under conditions prescribed by the Board of Health was allowed as a substitute for the tuberculin test.

The case was argued before the State Supreme Court in 1911, a large mass of testimony from some of the most eminent authorities in the country being taken, and every point at issue was decided in favor of the Board of Health. An appeal was taken by the company to the higher court of Errors and Appeals, but was later withdrawn, so that the legal status of the tuberculin-test requirement reverted to the Supreme Court decision and the ordinance became effective. By its firmness and persistency in upholding its case, which, moreover, required large legal expenditures, the Montclair Board of Health thus finally succeeded in establishing the legal basis for the statement of its Health Officer that " with the present-day knowledge of the relation between bovine and human tuberculosis any board of health that does not require the tuberculin test, or pasteurization of the milk as an alternative, must be considered negligent."

Below (somewhat rearranged) are the chief points in the summary of the Supreme Court decision.

1. Boards of Health are empowered by the act of 1897 (P. L. 270), and by the Pure Food Law of 1907 (P. L. 485), taken in conjunction with the act of 1887 (P. L. 80), to prohibit the sale of milk from diseased cows.

2. Whether cows from which a municipality is supplied with milk are diseased, is a question that may, in the first instance, be determined by the local board of health.

3. In determining whether cows from which a municipality is supplied with milk, are diseased, the method of diagnosis adopted by the local board of health should be one that is well recognized, thoroughly approved, and as reliable as any.

4. A local board of health may prohibit the sale within the municipality of milk from cows that react to the " tuberculin test."

(The following considerations relate particularly to the value of the *tuberculin test*):

7. We find that the tuberculin test is the most reliable method of diagnosis of tuberculosis in cattle now known; that while it is not perfect, the percentage of error is as small as in any method suggested, and that it is more accurate than the method by physical examination. We rest this conclusion not merely upon the testimony in the case but upon the fact that it has been approved by judicial decision in Minnesota, Louisiana, Wisconsin and Pennsylvania, and adopted by the most recent statute in Delaware, Indiana, Maryland, Michigan, Minnesota, New Mexico, North

Dakota, Oregon, Pennsylvania, South Carolina, Tennessee, Washington and Wisconsin, and for some purposes by Maine, Massachusetts and Vermont. The "tuberculin test" referred to in the act of South Dakota is probably the same. A similar act was passed by our own Legislature in 1899 (P. L., 484). These statutes are legislative testimony of cumulative force to the value of the tuberculin test as a diagnostic agent. We think, therefore, that the board of health is justified in the position that the cattle which react to the tuberculin test are diseased. That conclusion may occasionally be erroneous, but it is as nearly accurate as is possible. The statute empowers the board of health to prohibit the sale of milk from such cattle.

8. It seems to be established that there is very little chance of communication of bovine tuberculosis to human beings above the age of sixteen years, but that there is very serious danger of communication through the medium of milk to human beings under the age of sixteen years of age and especially to children under five years of age. It is conceded that there are such cases. The concession that bovine tuberculosis may be communicated to young children and that although it appears in them in the less common form rather than in the form of pulmonary tuberculosis, suffices to justify action to guard the young against the contagion. It is for the board of health to decide how many lives must be endangered, and whether the lives of a few infants or children are worth the effort and the financial loss.

9. The evidence justifies a finding that the subjection of the cows from which a supply of milk is derived to the tuberculin test is a reasonable method of determining not only whether they are diseased but also whether their milk may carry the germs of tuberculosis.

10. Surely milk from cattle that react to a tuberculin test, has been exposed to disease, and if the cattle themselves may be kept out of the state, it is fairly within the discretion confided in boards of health to exclude also milk, the produce of the cattle, which it is proved may at times convey the disease.

(The following have a general bearing on the *powers of health authorities*):

5. The action of a local board in adopting measures for the protection of public health will not be set aside by the court if the board has acted reasonably upon evidence that might satisfy a reasonable man.

6. Regulations for the protection of the public health are within the police power of the state and are not an illegal interference

> with interstate commerce if they have a real substantial relation to a public object which government can accomplish, and are not arbitrary and unreasonable and beyond the necessities of the case.

More recently a tuberculin test ordinance of the Milwaukee Board of Health has been upheld by the United States Supreme Court,[1] so that the legal status of the test is now practically established beyond question.

A tuberculin-test ordinance of Los Angeles, Cal., was defeated in 1912 by a popular referendum vote.[2] This, however, it is to be presumed, has no bearing upon the legal status of the test itself.

[1] *Am. Jour. Pub. Health*, 1913, vol. iii, no. 8, p. 837.

[2] *Am. Jour. Pub. Health*, 1912, vol. ii, no. 7, p. 586 and editorial.

APPENDIX D

THE HEALTH DEPARTMENT LABORATORY

The necessity of laboratory facilities in modern public health work has been brought out in the foregoing pages; also the fact that such facilities should be as near at hand as possible. The local laboratory is for most purposes the ideal, provided expert service is available. State laboratories are useful, especially as they may command the services of experts who devote their entire time to laboratory work while local bacteriologists may be employed for so few examinations that their practice does not keep up to par with the latest and best methods. But the disadvantage is that the state laboratory is usually at some distance, and the delay in transmitting specimens and obtaining results is a serious drawback in this class of work.

The *functions* of the laboratory include bacteriological and serum diagnosis (diphtheria, typhoid fever, tuberculosis, etc.), bacteriological and chemical work on milk and perhaps other foods, bacteriological tests of water-supplies (the chemical tests are beyond the range of the usual local laboratory), the keeping and distribution of antitoxins and other sera, etc. *Every health department should perform, or arrange to have performed, every kind of laboratory service required in public health work.* Thus routine examinations may be made locally, while if necessary unusual kinds of work may be transmitted, by arrangement, to a state or completely equipped city laboratory.

Since as much local work as possible should be done, and boards of health in small towns are frequently unable to afford to pay for the necessary installation and services, it is highly desirable that several neighboring towns combine in the maintenance of a *joint* laboratory and bacteriologist. Sometimes such a laboratory can be run in connection with a hospital requiring the services of a diagnostic bacteriologist. Where the valuable plan of a joint health office (see Appendix F) is in operation, the joint laboratory is a natural part of the scheme. Where two or more communities are thus linked together, — and even in single towns covering rather a large area, — arrangements may be made for several culture stations, e.g., in drug stores, where outfits may be secured and specimens left for collection and transmission to the laboratory at regular hours.

The following list of *laboratory equipment* for a small board of health laboratory, for diagnostic work, and examination of milk and water, with approximate costs, is taken from the paper by E. B. Phelps, quoted in Appendix F. In the installation of such a laboratory possible expenses for plumbing, gas piping, electric wiring, benches, cabinets, and other carpentering, refrigerator, and the like should be considered. To the list should also be added the cost ($30 or $40) of hot air and steam (Arnold) sterilizers. Exact costs may be figured by consulting the catalogues of the laboratory supply companies, some of which make a discount from their list prices. Once such a laboratory has been installed the running expenses are moderate.

Analytical balance	$125.00
Babcock machine and accessories, with special sediment head	100.00
Incubator	125.00
Microscope and accessories	125.00
1 gross diphtheria outfits, complete	15.00
1 gross typhoid and malaria outfits, complete	10.00
6 dozen sputum outfits, complete	5.00
1 gross ophthalmia loops	5.00
Glassware (see schedule)	150.40
Chemicals (see schedule)	22.35
Miscellaneous (see schedule)	78.00
Total	$760.75

Glassware

200 Petri dishes.
100 1-cubic-centimeter pipettes.
100 8-ounce bottles for dilutions.
10 gross 6-inch test tubes for media.
1 counting plate.
1 gross microscope slides.
1 dozen 4-ounce stain bottles.
2 Liebig condensers, 25 inches.
6 1-liter round-bottom flasks.
6 graduated cylinders, 100 cubic centimeters, 250 cubic centimeters, and 1 liter.
6 50-cubic-centimeter burettes, glass stoppered.
6 250-cubic-centimeter evaporating dishes.
2 pounds glass stirring rod.
12 Nessler jars, 50 cubic centimeters.
1 gross 8-ounce reagent bottles.

Chemicals

8 pounds acid, sulphuric.
6 pounds acid, hydrochloric.
1 pound acid, acetic.
1 pound acid, nitric.
1 pound acid, oxalic.
5 pounds alcohol.
4 ounces amidonaphthalene.
1 pound ammonium chloride.
1 pound copper sulphate.
1 pound ether.
1 ounce ferrous ammonium sulphate.
1 pound lead acetate.
1 pound mercuric chloride.
1 pound manganese sulphate.
1 pound phenol.
1 pound potassium permanganate.
1 pound potassium iodide.
5 pounds potassium hydroxide.
1 ounce potassium sulphocyanide.
1 pound silver nitrate.
1 ounce silver nitrite.
1 pound sodium thiosulphate.
1 pound sodium carbonate.
1 pound sodium chloride.
Stains and indicators.
1 ounce methyl orange.
1 ounce phenolphthalein.
1 ounce erythrosine.
1 ounce fuchsine.
1 ounce methylene blue.
1 ounce Bismarck brown.
4 ounces Wright differential blood stain.
1 pound starch (potato).
4 ounces sulphanilic acid.

Miscellaneous

5 grams No. 18 platinum wire.
1 platinum evaporating dish.
4 Bunsen burners.
4 ring stands.
5 pounds rubber tubing.
5 pounds cotton batting.

6 wire baskets for tubes.
Assortment enameled iron dishes and pans.
4 special milk-collecting baskets to order.
Printed forms, etc.
1 dozen box labels.
Other small articles.

REFERENCES

Bolling, "The Development of a Municipal Laboratory," *Am. Jour. Pub. Health*, 1912, vol. ii, no. 6, p. 409.

Standard Methods of the American Public Health Association for the examination of milk, air, water and sewage. These methods should be exactly observed by public health laboratories. (Apply to Am. Jour. Pub. Health, 755 Boylston St., Boston, Mass.: "Bacterial Examination of Milk and Air," 25 cents; "Examination of Water and Sewage, physical, chemical, microscopical and bacteriological," $1.25, postpaid.) Amendments are made by committee reports of the Laboratory Section of the Association from time to time.

No attempt can be made here to give a complete bibliography of the various works on the different phases of laboratory work. The following are among the more important:

Jordan, "A Text-Book of General Bacteriology," W. B. Saunders, Phila., 1914.

Park and Williams, "Pathogenic Micro-Organisms; including Bacteria and Protozoa," Lea Bros. and Co., Phila., 1910.

MacNeal, "Pathogenic Micro-Organisms" (based on Williams's "Manual of Bacteriology"), P. Blakiston Son and Co., Phila., 1914.

Prescott and Winslow, "Elements of Water Bacteriology," John Wiley and Sons, Inc., N. Y., 1914.

Rosenau, "Preventive Medicine and Hygiene," Appleton and Co., N. Y., 1913, secs. III (Foods), IV (Air) and VI (Water).

Woodman and Norton, "Air, Water, and Food" (composition and physical and chemical tests), John Wiley and Sons, Inc., N. Y., 1914.

Farrington and Woll, "Testing Milk and Its Products," Mendata Book Co., Madison, Wis., 1912.

Bull. 100, Bureau of Chemistry, U. S. Dept. of Agriculture, "Some Forms of Food Adulteration and Simple Methods for Their Detection."

The more exhaustive treatises on water, foods, milk, etc., may also be consulted.

APPENDIX E

RULES OF STATISTICAL PRACTICE

(Adopted by the American Public Health Association and by the Bureau of the Census.)[1]

RULES ADOPTED IN 1908

STATEMENT OF OCCUPATION

1. An attempt should be made to secure not only the kind of occupation (e.g., laborer), but also the kind of industry (e.g., pottery).

2. Occupations should be stated for all decedents over 10 years of age (and for decedents under 10 years of age if employed in a mill, factory or in any gainful occupation).

STATISTICAL DEFINITION OF DEATHS

3.[2] Total deaths, as stated in mortality reports and bulletins, should include *all deaths* that occurred in the area of the state or city during the specified time.

[1] 1908, 1909 and 1910 Rules from U. S. Census Bulletin 108 (Mortality Statistics, 1909); 1914 rules not yet in print at time of writing, but were furnished by courtesy of Dr. Louis I. Dublin, Secretary of Section on Vital Statistics, A. P. H. A.

[2] Referring to Rules 3, 11 and 15: the present ruling (which was adopted for reasons of expediency) requiring inclusion of deaths of non-residents is unsatisfactory for the reason that, if it is strictly followed, communities having hospitals and other institutions located within their limits have their death rates unduly swelled by the inclusion of the deaths of non-residents occurring in such institutions. It is therefore necessary, for correct interpretation of the figures, to state such deaths separately, and they should, in fact, be tabulated entirely apart throughout statistical reports. Such tabulations should, however, be accompanied by a statement of the general death rate including all deaths within the district and a statement indicating exactly what rule for exclusions has been followed. Such procedure is sanctioned by the following resolution adopted by the American Public Health Association in 1913:

"Pending the final determination as to forms of statistical tables

STILLBIRTHS (AS RELATED TO DEATHS)

4. Stillbirths should not be included in deaths.

5. Children born alive and *living for any time whatever*, no matter how brief, after birth, should not be classed as stillbirths, even though reported by the attending physicians or midwives as "stillborn."

6. Whenever age, in days, hours, or minutes, is reported for a "stillborn" child, or indicated by a difference between dates of birth and death, the registrar should secure a statement that will enable the case to be classed with certainty either as a stillbirth or as a death. If no additional information can be obtained, the statement of age should govern, and the case be compiled as a death, not as a stillbirth.

PREMATURE BIRTHS

7. Premature births (not stillborn) should be included in total deaths (classified under International Title No. 151) [and in total births].

8. Premature births (stillborn) should be classed under stillbirths, and should not be included in total deaths.

9. When a premature birth is reported as "stillborn" and an inconsistent statement of age (days, hours, minutes) is also given, the registrar should endeavor to secure a statement that will enable the case to be classed with certainty either as a stillbirth or as a death. If no additional information can be obtained, the statement of age should govern, and the case be compiled as a death, not as a stillbirth.

10. When a premature birth is reported with no statement of age (space left blank), the local registrar should endeavor to obtain a statement of age, or at least that the child was born alive; but, in the absence of any further data, the case should be compiled as a stillbirth.

DEATHS OF NON-RESIDENTS

11.[1] All deaths of transients or non-residents occurring in a state or city should be included in the tables of total deaths.

and the adoption of definite rules of statistical practice, it is the sense of the Section on Vital Statistics of the A. P. H. A. that bulletins and reports may contain (1) a statement of mortality including deaths of all persons and for all causes with corresponding death rates, and (2) a statement of mortality based on deaths of residents only with corresponding death rates, which should be accompanied with a full explanation as to the exact class of cases and period of time of residence covered in the exclusions."

It is to be hoped that some definitive ruling will be given in the near future. See also page 617 (rules pending) and the discussion on page 507 f. (note) of the present volume. — AUTHOR.

[1] See preceding note.

DEATHS IN INSTITUTIONS

12. Deaths of residents of a city in a hospital or institution situated within the city limits should be distributed by the local registrar to the districts of residence (borough, ward, sanitary district) as far as possible.

PERIOD COVERED IN BULLETINS AND REPORTS

13. Total deaths should include all deaths that occurred in the given area during the period stated in the table, and no others:

(*a*) A weekly bulletin should include all deaths that occurred during the week ending at 12 p.m., Saturday, and no others: Provided, that in order to secure earlier publication, a weekly bulletin may include "*deaths reported*" up to any time, but should definitely state that fact.

(*b*) A monthly bulletin should include all deaths that occurred during the calendar month, and no others. [Amended, see Rule no. 1, 1910, below.]

(*c*) An annual report should include all deaths that occurred during the calendar year, and no others.

HEADINGS OF TABLES

14. Every table of total deaths should explicitly state in its heading that stillbirths are not included, and if any classes of deaths are omitted from a table apparently relating to total deaths, the items excluded should be explicitly stated either in the heading or in a footnote.

DEATH RATES BASED ON TOTAL DEATHS

15.[1] Any statement of the death rate (general, crude or gross death rate) of a state or city should be understood to be based, unless expressly qualified, upon the *total deaths, exclusive of stillbirths*, and without any omissions of deaths whatsoever.

VIABILITY OR NONVIABILITY

16. Statement of viability or nonviability of an infant prematurely born shall not be considered in classification.

STATISTICAL DEFINITION OF STILLBIRTHS

17. For registration purposes, stillbirths should include all children born who do not live any time whatever, no matter how brief, after birth.

[1] See note, p. 612.

18. Birth (completion of birth) is the instant of complete separation of the entire body (not body in the restricted sense of trunk, but the entire organism, including head, trunk and limbs) of the child from the body of the mother. The umbilical cord need not be cut or the placenta detached in order to constitute complete birth for registration purposes. A child dead or dying a moment before the instant of birth is a stillbirth, and one dying a moment, no matter how brief, *after* birth, was a living child, and should not be registered as a stillbirth. [In the latter case both a birth certificate and a death certificate should be filed.]

19. No child that shows any evidence of life after birth should be registered as a stillbirth.

20. Stillbirths should not be included in tables of births or in tables of deaths. They should be given in separate tables of stillbirths.

21. It is not desirable that midwives be allowed to sign certificates of stillbirths.

STATISTICAL DEFINITION OF BIRTHS

22. Total births should include children born alive only, and headings of tables should state that stillbirths are excluded.

23. Whenever, under the foregoing rules a death should be registered, there should be a corresponding registration at some previous time of a birth; and whenever a stillbirth is registered it should be rigorously excluded from both the statistics of births and deaths.

ESSENTIAL REQUIREMENTS FOR THE REGISTRATION OF DEATHS

24. The deaths must be recorded immediately after their occurrence.

Note. — In statistical practice the terms "record" and "recording" should be used in the limited sense of receiving and filing, while the term "register" and "registration" should be used as embracing the further idea of inclusion of the records in the statistics of the area.

25. Certificates of death of standard form should be used.

26. *Burial or removal permits* are essential to the enforcement of the law.

27. Efficient local registrars are necessary.

28. The responsibility for reporting deaths to the local registrar should be placed upon the undertaker or other person having charge of the disposition of the body.

29. The central registration office should have full control of the local machinery, and its rules should have the effect of law.

30. The transmission and preservation of returns should be provided for.

31. Penalties should be provided and enforced.

[Additional rules regarding deaths adopted in 1910 (see below).]

ESSENTIAL REQUIREMENTS FOR THE REGISTRATION OF BIRTHS

32. Births must be recorded immediately after their occurrence.

33. Certificates of birth of standard form should be required.

34. Some *check* is necessary to secure enforcement of the law.

35. Efficient local registrars are necessary.

36. The responsibility for reporting births to the local registrar should be placed upon the attending physician or midwife, and upon the parents if no physician or midwife was in attendance.

37. The central registration office should have full control of the local machinery, and its rules should have the effect of law.

38. The transmission and preservation of returns should be provided for.

39. Penalties should be provided and enforced.

METHOD OF TESTING ACCURACY OF REGISTRATION OF DEATHS

40. The accuracy (completeness with respect to total number) of the registration of deaths in a state or city may be satisfactorily determined by the proportion found actually registered out of a sufficiently large number (10 per cent of the total ?) derived from any independent source, e.g., newspaper reports, and properly distributed throughout the state.

41. Local registrars should regularly note newspaper reports of deaths, in order to detect omissions and secure complete registration.

42. Registrars should periodically examine the records of interments in cemeteries used by their districts and check up any interments made without proper registration and permit, in order to ascertain the number of unregistered deaths.

METHOD OF TESTING ACCURACY OF REGISTRATION OF BIRTHS

43. The accuracy (completeness with respect to total number) of the registration of births in a state or city may be satisfactorily determined by the proportion found actually registered out of a sufficiently large number (10 per cent of the total ?) derived from any independent source, e.g., newspaper reports or lists of infants registered as births, and whose certificates of death enable the place and date of birth to be fixed, provided they are properly distributed throughout the state.

CONSTRUCTION OF STANDARD TABLES OF VITAL STATISTICS

44. Every state or city registration office should publish an annual (or biennial) report and include therein a table showing the population (as estimated by the United States Census Bureau for intercensal years), total number of births exclusive of stillbirths, total number of deaths exclusive of stillbirths, total number of stillbirths, total number of marriages[1] and total number of divorces[1] for each year of registration.

[1] Provided this item can be obtained.

45. It is desirable that the corresponding rates be given, but the primary figures should be presented whether it is possible to present rates or not.

46. Notes should be given in all instances where discrepant figures have been officially printed relative to returns for any year, and the correct figures should be definitely stated.

47. Notes should be given on changes in methods of compiling stillbirths, and a correct statement of stillbirths should be established for each year, on the basis of the definitions approved. If necessary, re-examination of the original return should be made for the purpose of obtaining comparable figures.

ADOPTION OF UNIFORM AGE PERIODS IN MORTALITY STATISTICS

48. Unknown ages should never be accepted in returns. The approximate age, according to the best judgment of the reporter, should be given if the exact age is unknown. When accepted by the central registration office, however, they should be given a place in the statement of ages, in order to show the imperfect quality of registration.

RULES ADOPTED IN 1909

Revised United States Standard Certificate of Death

[The five rules adopted in 1909 (with Rule no. 2 of 1910) provide for a uniform mode of statement of causes of death upon certificates of death, the need of efforts to obtain more definite and satisfactory statement of causes of death, and prescribing the adoption of the Revised United States Standard Certificate of Death (or at least of the standard form of statement of cause of death and occupation) with the minimum instructions printed on the reverse thereof.[1] It is also advised that instructions in regard to reporting of occupations be uniform in population, industrial and mortality schedules (certificates of death).]

RULES ADOPTED IN 1910

1. [APHA] Rule no. 13 of 1908, paragraph (*b*), shall be amended to read as follows:

"(*b*) A monthly bulletin should include all deaths that occur during the calendar month and no others, provided, however, that in order to secure earlier publication, a monthly bulletin may include '*deaths reported*' during the calendar month, but should definitely state that fact."

[1] Copies of the certificate may be obtained on application to the Division of Vital Statistics, Bureau of the Census.

2. The instructions as printed upon the reverse side of the Revised Standard Certificate of Death in regard to the reporting of occupation shall be the minimum instructions employed for this purpose, and shall be enforced as provided for by [APHA] Rule no. 3 of 1909 [i.e., by state registration offices].

3. Passengers dying on trains or vessels should be registered as deaths at the station or port where the bodies are removed.

4. Deaths caused by railroad accidents or by disasters incident to navigation should be registered in the district that includes the place of death, or where the bodies were brought ashore.

5. [Provides for a modified form of the Standard Certificate of Death for the use of coroners (or medical examiners) where such special forms are deemed necessary.]

RULES ADOPTED IN 1914

1. It is desirable that all stillbirths, irrespective of the month of uterogestation, be registered.

2. A table of stillbirths should be given which will show the number registered at each completed month of uterogestation, together with the number for which no statement of the duration of uterogestation was given.

3. For comparative statistical purposes the main tables of stillbirths should include only those stillbirths which have attained the age of six (6) completed months of uterogestation, or, in other words, have advanced to the seventh (7th) month of uterogestation or were born after the sixth (6th) month of uterogestation. Such tables should state explicitly that they exclude certain stillbirths that were or might be registered: "Stillbirths (exclusive of those stated as less than six months of uterogestation)."

[No rules were adopted in 1911, 1912 or 1913. Rules are still pending which propose: (1) that separate columns for deaths of non-residents may be given including deaths in hospitals and institutions and of transients and non-residents at place of death less than 6 (?) months and less than the duration of the disease causing death; (2) that deaths of residents occurring in institutions (e.g., almshouses) situated outside of a city but which draw inmates therefrom be included in the statistics of the city; and (3) that deaths in state or government institutions be included in the statistics of the areas containing them, but that special columns may be employed to permit separate statement as in case of non-residents.]

APPENDIX F

COÖPERATIVE HEALTH ADMINISTRATION AMONG SMALL COMMUNITIES

There is today in the public health field no more vital problem than how small towns and cities can, with their limited resources, obtain the expert service which they require. This pressing problem has already been discussed in Part I, Chapters I and II, in which two possible solutions were outlined. One of these is the New York State plan, by which a greater degree of supervision of state over local authorities is established, — a plan which at the present time (1914), while holding out great promise, is still in the inceptive stage. The other plan is that of *coöperative maintenance of a joint health office by two or more neighboring communities.* Fortunately there are already available data on the successful outcome of an experiment — the first noteworthy one of its kind — illustrating the joint plan as it has been worked out in a certain group of Massachusetts towns. The results are set forth at length in a recent paper by Earle B. Phelps, summarized as follows:

> The local health office in the smaller communities is the most essential and least efficient part of the present-day public health machine. The highly specialized character of public health work and the financial inability of the smaller community to support a properly trained health organization are in large measure responsible for this condition.
>
> Consolidation of adjoining communities in a coöperative health office will provide a sufficient population to support the requisite minimum organization for efficient health work at a per capita charge much less than that usually imposed in the larger cities for work of a similar character.

The Coöperative Plan

The details of such a coöperative effort inaugurated among certain Massachusetts towns by the officers of the department of biology and public health of the Massachusetts Institute of Technology are given.

This work was assisted by the Surgeon General of the United

States Public Health Service through the detail of a sanitary bacteriologist and through the devoting of a portion of the writer's time to the general supervision of the work since October 1, 1913.

An organization comprising an administrative officer, a bacteriologist and secretary, a sanitary and plumbing inspector, a field assistant, and two clerks served a population of 32,650 in all departments of the work except plumbing inspection (a population of 8385 being served) and an additional population of 30,000 in milk inspection and control, at a cost of $7603.51 for the year.

The output of such a health office can be increased by the appointment of assistance at less than a proportionate increase in maintenance costs.

Results

The prompt measures taken in the preliminary investigation of every case of contagious disease, backed up by the findings of the diagnostic laboratory, have, in at least two cases, prevented serious outbreaks of contagious disease and would undoubtedly have prevented a third outbreak and one death had they been in force in a neighboring town from which a carrier case was imported.

The average bacterial content of the milk supply has been reduced by approximately two-thirds without any restrictive measures having been imposed upon the producers themselves other than those already in force. This has been done by a systematic laboratory control of the milk supply embodying monthly chemical and bacterial analyses, by a policy of publicity, and by helpful, constructive criticism given to the producers upon request. The improvement is of especial significance in view of the generally good quality of the milk supplies in question. Starting with 32 per cent of the individual supplies below 10,000 bacteria per cubic centimeter and 50 per cent below 20,000, one year later 31 per cent were below 5000, 56 per cent below 10,000, and 74 per cent below 20,000.

Prompt and energetic measures were adopted in the control of contagious diseases, every effort being made to locate the initial source.

Campaigns for mosquito and fly suppression were carried through successfully.

Costs

An accounting system, showing full details of the costs of this work, was employed. The work of the diagnostic laboratory and the milk inspection and control cost approximately 3 cents per capita per annum each, and the work of sanitary inspection and

control of contagious disease cost slightly more. The total cost of the work, exclusive of plumbing inspection, was 19 cents per capita per annum.

A population of about 60,000 would develop each of the various subdivisions of the work to a point of maximum efficiency and could support the work of a complete organization, including two district nurses and medical and veterinary advisory services, at a per capita cost (exclusive of plumbing inspection) of one-half the average cost of board of health work in the large cities of the United States.

Organization

Such a coöperative office may be organized among the towns themselves, through the initiative of State or educational authorities, or under the direction of a consulting sanitarian, or it may be conducted entirely by an outside consulting office specializing in public health work.

The equipment and duties of a local health office, the problems of local administration and the minimum requirements of such an office are discussed at some length, and the year's work under a permanent organization is reported upon in detail, with analysis of costs. Appendices giving the form of agreement adopted and a list of the necessary laboratory equipment for a small board of health laboratory (see Appendix D of present volume) are added.

Such a coöperative plan, it may be added, does not necessarily imply the consolidation of town interests in any other respect than that of public health, or even complete consolidation in that.

This important paper is printed in *Public Health Reports* for September 25, 1914 (copies of which may be obtained from the U. S. Public Health Service, Washington), and should be carefully read by all health officers for its analysis of needs and methods as well as for its account of the coöperative plan.

APPENDIX G

STANDARD PLAN FOR ANNUAL REPORTS[1]

FOREWORD

This report is a schematic outline, more or less detailed, for annual reports of municipal boards of health. By expansion or contraction, the outline submitted may be applied to cities of any size. As it deals only with fundamentals, its adoption need not prevent originality of treatment.

GENERAL OUTLINE

I. Title Page.
II. Members of Board and Staff.
III. Table of Contents.
IV. Summary of the Year's Work.
V. Report of the Executive Officer.
  1. Introduction.
  2. Vital Statistics.
  3. Communicable Diseases.
  4. Infant Welfare.
  5. Medical Inspection of Schools.
  6. Foods and Drugs.
  7. Water and Ice Supply.
  8. Sanitary Inspection of Buildings.
  9. Nuisances.
  10. Municipal Wastes.
  11. Plumbing.
  12. Insects and Rodents.
  13. Special Problems and Research.
  14. Publicity.
  15. New Ordinances.
  16. Prosecutions.
  17. Conclusion and Recommendations.
VI. Financial Statement.

[1] Health Officers' Association of New Jersey, 1913. The plan adopted by the Mass. Assn. of Boards of Health, which is closely comparable with the above, has already been published in the *Am. Jour. Pub. Health* (1913, vol. III, no. 6, p. 595). The Massachusetts plan embraces: a form for a report suitable for cities of 30,000 inhabitants and over, a form for smaller places, explanatory notes and forms for tables.

When no work has been done along any line indicated in the general outline, statistics should be presented to demonstrate existing needs; or, if the work has been done by another municipal department or by a private organization, that fact should be noted. Special endeavor should be made to interpret concisely all tabulated statistics. In the following outlines, capital letters in brackets indicate tables.

REPORT OF THE EXECUTIVE OFFICER

Section 1, Introduction

Section 2, Vital Statistics

Comment should be made on existing laws, methods of enforcement and need for further legislation.

I. POPULATION

(A) POPULATION as of July 1 for the year and for each of the ten years preceding. Estimates should be made according to the method of the U. S. Census Bureau. (Reference no. 1 at the end of the report.)

(B) POPULATION, for the current year at least, tabulated by (1) wards, (2) age periods, (3) color and (4) principal nationalities.

II. BIRTHS

Children born to non-resident mothers in hospitals should be tabulated separately. Stillbirths should be tabulated separately, not with births or deaths.

(A) BIRTH RATES per thousand of population for the year and for each of the ten years preceding.

(B) BIRTH RATES, for the current year at least, by (1) wards, (2) color and (3) principal nationalities.

(C) NUMBER OF BIRTHS tabulated by (1) wards, (2) color, (3) principal nationalities, (4) sex, (5) number of child, (6) plural births, (7) legitimacy, (8) number attended by midwives and (9) completeness of the certificates as to the given name of the child.

III. DEATHS

Deaths should be classified according to the international system. (Reference no. 2.) Deaths of non-residents in hospitals should be tabulated separately.

(A) DEATH RATES per thousand of population for the year and for each of the ten years preceding by (1) wards, (2) color and (3) principal nationalities.

(B) DEATH RATES per hundred thousand of population for deaths during the current year due to communicable diseases and principal causes.

(C) NUMBER OF DEATHS during the year tabulated by (1) wards, (2) color, (3) principal nationalities and (4) age periods.

Each cause for which there was an unusual number of deaths should be discussed in detail.

IV. MARRIAGES

(A) MARRIAGE RATE per thousand of population.

(B) NUMBER OF MARRIAGES classified according to (1) residence, (2) color and (3) principal nationalities.

Give the name and title of the person issuing marriage license and any other necessary information relating thereto.

Section 3, Communicable Diseases

Distinguished as to *residence of the cases and place where disease was contracted;* i.e., separate locally contracted cases of residents, cases of residents contracted out of town and imported cases of non-residents. Exclude from local statistics cases of non-residents treated in local hospitals and include, so far as possible, cases of residents treated at out-of-town hospitals. State the method of disinfection used (give names and quantities of materials) and show for what diseases employed.

(A) CASES AND DEATHS for each of the communicable diseases for the year and for each of the ten years preceding.

(B) DEATH RATES per hundred thousand population for the year for each of the chief communicable diseases.

(C) DEATHS FROM PRINCIPAL COMMUNICABLE DISEASES tabulated by (1) wards and (2) months.

(D) CASE MORTALITY for each of the chief communicable diseases.

Discuss prevalence, methods of control, possible sources of infection, use of laboratory diagnosis, average length of isolation, and methods of determining time of release for each of the communicable diseases.

For diphtheria, tabulate length of isolation by five-day periods and for scarlet fever, by weeks, separating home and hospital cases. Indicate, also, extent of hospital treatment and numbers of multiple and return cases. A statement as to the use of antitoxin should be made under the heading of diphtheria, giving number of cases where used, result on mortality and extent of free distribution to indigent persons.

Distinguish between " pulmonary " and " other forms " of tubercu-

losis. If anti-tuberculosis work is carried on by private agencies, an outline of its extent and character should be given.

Under the heading *smallpox*, give (1) the vaccinal status of all cases, (2) of all school children and (3) the extent of free vaccination.

Section 4, Infant Welfare

Conditions affecting infant welfare and all agencies and means for reducing infant mortality should be discussed.

(A) NUMBER OF DEATHS during the year and each of the ten years preceding, (1) under five years of age, (2) under one year and (3) percentage of total deaths for each of these age groups.

(B) RATE OF DEATHS UNDER FIVE YEARS PER THOUSAND OF POPULATION UNDER FIVE YEARS by (1) wards, (2) color and (3) principal nationalities.

(C) DEATHS UNDER FIVE YEARS OF AGE tabulated by (1) days, for the first week, (2) weeks, for the first month, (3) months, for the first year and (4) by years for the first five years, showing (*a*) chief causes of death, (*b*) color and (*c*) nativities of parents.

(D) DEATHS FROM DIARRHŒA AND ENTERITIS UNDER TWO YEARS OF AGE (title 104 of the International Classification) and rate per hundred thousand of population for the year and for each of the ten years preceding.

(E) RATE OF DEATHS UNDER ONE YEAR OF AGE PER THOUSAND BIRTHS for the year and for each of the ten years preceding, tabulated by (1) wards or districts, (2) color, (3) nationalities, (4) hospital or institutional care and (5) seasonal distribution.

Section 5, Medical Inspection of Schools

Public and private schools should be reported separately. Separate reports for general, dental, eye and other kinds of examinations, to include the work of examining physicians, of the school nurse and of free clinics. State whether school or calendar year is covered and report for the last complete year.

Section 6, Foods and Drugs

An outline of the food control problem and its sanitary significance is necessary to a proper appreciation of the work of this department. Endeavor to make all information, especially such as relates to the standing of the various milk supplies, comprehensible and useful to the public. Technical terms should be explained or avoided. The dairy

score card devised by the U. S. Department of Agriculture is recommended. Any deviation from the laboratory methods of the American Public Health Association should be mentioned and explained. The methods described in the report of the Committee on Milk Standards are recommended. (Reference no. 3.) Explain system of dairy and creamery inspection.

(A) GENERAL AVERAGE OF DAIRY SCORES for each of the preceding five or more years.

(B) NUMBER (OR PER CENT) OF DAIRIES WHOSE SCORES FELL BETWEEN CERTAIN LIMITS for above years.

(C) TABLE OF ALL RETAIL DEALERS giving scores of dairies supplying each.[1] State whether milk dealers are licensed by the Board and give the number of milk supplies excluded with reasons.

Indicate the method and frequency of taking samples of milk and cream for analysis.

(D) GENERAL AVERAGE BACTERIA COUNT (OR BACTERIAL CONTENT, Reference no. 3) for each of the preceding five or more years.

(E) INDIVIDUAL AVERAGE (OR " BACTERIAL CONTENT ") for each dealer for the year.[2]

(F) MONTHS DURING WHICH EACH DEALER'S BACTERIA COUNT FELL WITHIN CERTAIN LIMITS.

(G) Where " loose " milk is sold, contrast the bacteria counts of bottled and loose milk.

(H) BACTERIA COUNTS. Results of each analysis for each dealer.

(I) FAT AND TOTAL SOLIDS. Figures for percentage fat and total solids may be given correspondingly with bacteria counts in (D), (E) and (H) above and may be conveniently included in tables with the latter.

Microscopic examinations and tests for sediments, preservatives and thickeners should be recorded if made.

Give results of inspection and measures to protect each kind of food, both during preparation (at slaughterhouses, bakeries, ice cream factories, etc.), and during sale (at restaurants, markets, etc.). Report

[1] It scarcely need be said that these scores should be up to date at time of report, and that dealers should have been given a reasonable time to make improvements before scores are published by name. — J. S. M.

[2] Bacteria tests must be sufficiently numerous to give a fair average for each dealer. — J. S. M.

on the adulteration and misbranding of foods and drugs and the sale of habit-forming drugs, if subjects for local action.

Section 7, Water and Ice Supplies

Sources, quality and treatment of the various public and private water supplies; results of analyses and inspections. Similar data for ice supplies.

Section 8, Sanitary Inspection of Buildings

Results of inspections of schools, tenements, lodging houses, hotels, factories and other buildings.

Section 9, Nuisances

Classify and tabulate complaints received during the year as to (1) nature of complaint and (2) abatement. House-to-house inspections, control of special nuisances: (1) disposal of excreta, (2) dead animals, (3) smoke, (4) foul odors, (5) poisonous gases, (6) noise, etc.

Section 10, Municipal Wastes

Describe the system of collection and disposal of (1) garbage and offal, (2) ashes and non-combustible waste and (3) combustible waste, considering each separately under the following heads: (*a*) methods (by whom, for combined or separate, frequency), (*b*) amounts (in cubic yards or tons), (*c*) costs and (*d*) nuisances and complaints arising from methods of collection and disposal.

Section 11, Plumbing

(A) Permits of each class for the year and for each of the five years preceding.
(B) Permits granted during the current year in (1) old and (2) new buildings, by wards.
(C) Tabulation of preliminary tests, final tests and inspections passed and not passed, during the year.
(D) Sewer connections. Number of permits and inspections.
(E) Give number of dwellings not connected with the sewer on (1) sewered streets, and (2) unsewered streets.
(F) Permits and tests for gas piping and fixtures.

Section 12, Insects and Rodents

Relation to public health, location of breeding places and measures of extermination.

Section 13, Special Problems and Research

Epidemiology and etiology of communicable diseases; improvements in administrative and laboratory methods.

Section 14, Publicity

Bulletins, exhibits, lectures, instruction in sanitation in the public schools, books on sanitation in the public library.

Section 15, New Ordinances

Give sections of special importance in full, others in abstract.

Section 16, Prosecutions

Causes, results, courts where prosecuted and amount of penalties collected.

Section 17, Conclusions and Recommendations

FINANCIAL STATEMENT

Use the outline given in reference no. 4. Include statement of bills outstanding and receivable and statement of supplies on hand at the beginning and close of fiscal year.

REFERENCES

No. 1. Bulletins no. 108 (pp. 8 and 9) and 109 (p. 9), Bureau of the Census.

No. 2. International Classification of Causes of Sickness and Death, Bureau of the Census.

No. 3. Reprint no. 78 from Public Health Reports, U. S. Public Health Service.

No. 4. Uniform Accounts as a Basis for Standard Forms for Reports of Financial and Other Statistics for the Health Department, by L. C. Powers, Bureau of the Census.

[It will be noted that in the above plan the details of laboratory work are distributed under the various heads.

For details of vital statistics consult Chapter IX, of present volume.]

APPENDIX H

HEALTH OFFICE FORMS

The following is a suggestive list of health office forms intended to represent the minimum requirements of the health department of a small city. It should naturally be modified to suit local requirements, for it is obvious that some departments would require forms which do not appear in the list, while others would perhaps employ procedures to which certain of the forms suggested are not applicable. In most cases printed forms are requisite.

GENERAL

Inspector's daily (or weekly) report blank. (Loose-leaf notebook advisable for daily records.) Daily record should account in detail for use of time.

COMMUNICABLE DISEASE

Physicians' (postal) report card for new cases, also for recoveries and deaths (two forms on same card).

History cards for diphtheria, scarlet fever, typhoid fever, etc.

Placards.

Instructions regarding isolation and disinfection.

Book record for communicable diseases.

Spot map of cases.

Permit to attend school, business, etc.

Physicians' application and receipt for diphtheria antitoxin or other serum (indigent cases).

Forms to accompany bacteriological specimens (diphtheria, etc.) (name, address, etc.).

Laboratory book record of examinations.

Tuberculosis:[1]

Physicians' special report blank for new cases (sealed envelope — health departments should furnish self-addressed envelopes).

Physicians' special report blank for removals and deaths (sealed envelope).

[1] Records of tuberculosis to be kept separate and distinct from those of other communicable diseases.

History card (with blanks or extra card for recording visits of nurse).

Special book record.

Form to accompany sputum specimens.

Instructions for tuberculosis patients.

Requisition form for sputum cups, etc.

(Clinic records.)

Spot map of cases and deaths (not public).

(The law usually prescribes that tuberculosis records be kept private.)

CHILD HYGIENE

History card for each case, giving essential data, records of nurse's visits, consultation station (or clinic), examinations, weights, diets, etc.

Monthly summary of work of nurse.

Monthly summary of work of consultation station.

Cards for clinic appointments (language of mother).

Instructions for care of baby, diets, etc.

Physicians' report card for cases of enteritis.

MILK SUPPLIES

License and permit forms. Application form for license (sources of supply, etc.).

Score or inspection forms for dairies, creameries, bottling plants.

Laboratory records for recording results of analysis and notifying dealers.

OTHER FOOD SUPPLIES

Score or inspection forms and forms of notification for bakeries, confectioneries, ice-cream factories, places where beverages are dispensed, restaurants and the like.

WATER

Forms for recording inspections of wells, etc., and analyses, so far as required.

HOUSING

House-to-house inspection forms.

Summary reports on house-to-house inspection (by streets), with objectionable conditions found.

Gas inspection: — forms for new installations similar to those used for plumbing inspection; forms for recording inspections of old systems, tags for leaky fixtures and notification forms.

Plumbing inspection:[1] (1) bond and registration forms; (2) plan of

[1] Plumbing inspection should be removed from the health department and assigned (where this is not already the case) to some other and appropriate department, such as that of building inspection.

proposed work; (3) permit placard to proceed with work; (4) inspection certificates for roughing and water (or smoke) tests; (5) index card catalogue of plans.

NUISANCES

Inspector's report (a form $8\frac{1}{2}$ by 11 inches, to which duplicates of notices, etc., may be attached, and which may be folded twice for filing, is convenient).

Notice blanks[1] (to abate nuisance, make sewer connection, etc.) in proper legal form.

Inspector's notification blank (see under "oral notification," p. 447).

Reinspection slip (to be used as inspector's memorandum until nuisance is abated).

Special forms for fly and mosquito inspections and notices, etc.

"No spitting" placards for public buildings, etc., and warning cards or slips for spitters (for use by police, street-car conductors, etc.), if required.

VITAL STATISTICS[2]

Standard birth and stillbirth certificates.

Blank for supplementary report of given name of child, with explanatory slip to accompany same.

Standard death certificate.

Burial and removal permits.

Transcript books for preserving local copies of records.

Forms for certified copies.

PERMITS

Application and permit forms.

PUBLICITY

Various.

REGULATIONS

Health authorities should keep in print their ordinances in the form of an indexed code. Printed copies of sections or articles dealing with specific subjects, such as communicable disease,[3] milk, etc., should also be kept on hand. If ordinances are published in newspapers, reprints should be ordered at time of publication.

[1] In some cases a special letter is preferable to the printed form.

[2] Vital statistics forms should be uniform and should be furnished by the state bureau of vital statistics.

[3] The Montclair, N. J., Board of Health publishes a pamphlet of "Rules, Regulations and General Information Concerning Communicable Diseases" for distribution to physicians, school authorities, etc., which is an excellent example of what may be done in this line.

APPENDIX I

NEW YORK STATE SANITARY CODE

Following the recent reorganization of the New York State Department of Health, with special reference to the improvement of local administration, the first and chief duty of the Public Health Council was the framing of a Sanitary Code to apply to the entire State with the exception of New York City.

The aim of the Council in this important work was "to secure to the citizens of the State all the advantages which science and experience, especially during the last quarter of a century, have offered in the prevention of disease and in the promotion of the common welfare, with the least possible interference with the business, comfort and convenience of the people concerned." And, further, "to eliminate . . . the useless sanitary procedures which mark the views and practices of an earlier day, now replaced by exact knowledge; to abandon in its text those technical terms which though still often used have lost their earlier meanings and values, and also those which are not readily comprehensible to the citizens for whose use and guidance the code is framed."

Of special interest are the regulations relating to the control of communicable disease, from which the following declarations as to incubation periods and isolation are taken.

> **Regulation 35. Maximum period of incubation.** For the purpose of this code, the maximum period of incubation (that is, between the date of the exposure to disease and the date of its development), of the following communicable diseases is hereby declared to be as follows:

Chickenpox	21 days
Measles	14 days
Mumps	21 days
Scarlet fever	7 days
Smallpox	20 days
Whooping cough	14 days

Regulation 36. Minimum period of isolation. The minimum period of isolation, within the meaning of this code, shall be as follows:

Chickenpox, until twelve days after the appearance of the eruption and until the crusts have fallen and the scars are completely healed.

Diphtheria (membranous croup), until two successive negative cultures have been obtained from the nose and throat at intervals of twenty-four hours.

Measles, until ten days after the appearance of the rash and until all discharges from the nose, ears and throat have disappeared and until the cough has ceased.

Mumps, until two weeks after the appearance of the disease and one week after the disappearance of the swelling.

Scarlet fever, until thirty days after the development of the disease and until all discharges from the nose, ears and throat, or suppurating glands have ceased.

Smallpox, until fourteen days after the development of the disease and until scabs have all separated and the scars completely healed.

Whooping cough, until eight weeks after the development of the disease or until one week after the last characteristic cough.

This Code, which is the latest word in sanitary regulations, covers in some detail the control of communicable disease and the other branches of sanitary administration, including classification of milk supplies. For further details the reader is referred to the printed regulations, which may be obtained from the State Department of Health, Albany, N. Y.

The Public Health Council also fixes the qualifications of division directors, sanitary supervisors, health officers and public health nurses, and regulates midwifery. A subject of peculiar interest dealt with by the regulations is that of labor camps.

INDEX